FRUIT GROWING IN SOUTH AFRICA

CENTRAL NEWS AGENCY
SOUTH AFRICA

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BY

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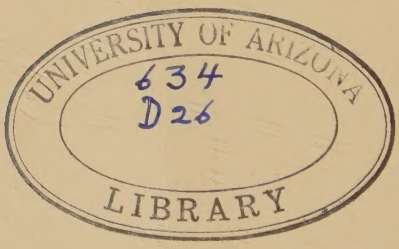

FOREWORD

In the foreword to " Citrus Growing in South Africa " I expressed the hope that at some future date, subsequent to the publication of that book, I should be able to indite another epistle to the Fruit Growers in this sub-continent.

This work, " Fruit Growing in South Africa," marks the fulfilment of that hope, and is submitted to those members of the community who may be interested in what, from small beginnings at the close of the last century, has grown to be a business proposition of large proportions in this present year of grace.

The fruits dealt with comprise all which are grown on a commercial scale in the country and the subject is approached from a South African viewpoint. The author's own wide experience with and knowledge of the various fruits and nuts has principally been drawn upon, but any information from other sources calculated to be of use or benefit has been fully exploited.

The words of Goethe, that great German writer, have been borne in mind. He said :

" If I could give an account of all that I owe to predecessors and contemporaries, there would be but a small balance in my favour; in fact we are all collective beings, do what we may; for how little have we or are we that we may strictly call our own property? We must receive all and learn, both from those who were before us and those who are with us. Even the greatest genius would not go far if he willed to draw everything out of his own internal self."

R. A. Davis.

Many of the chapters on the different varieties of fruit have appeared in the *Farmer's Weekly*.

R. A. D.

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FRUIT-GROWING IN SOUTH AFRICA

CHAPTER I

THE EARLY STAGES AND DEVELOPMENT OF THE FRUIT-GROWING INDUSTRY IN SOUTH AFRICA

In the middle of the seventeenth century, when "The Cape of Good Hope" had but recently been brought under Dutch rule, the first Governor, Van Riebeek, made the earliest recorded importation of fruit and other exotic trees. It is stated that amongst the kinds he imported were the Orange, Lemon, Citron, Banana, and Olive. There were also Walnuts and many kinds of Grape Vines. Possibly fruit trees of other varieties were brought in later, as opportunity offered. From the evidence which exists in the environs of Cape Town, and what is colloquially termed "The Shank End," it is easy to conjecture that certain types of Apples, Pears, Plums, Peaches, and Apricots were introduced about the same period.

The Dutch East India Company had instituted a garden on the slopes of Table Mountain of some nineteen acres, and conducted a nursery there, in addition to having planted Apricots, Apples, and Almonds and many kinds of Citrus fruits. Van Riebeek had also laid out a private garden of his own at Boscheuvel, so that by the end of the century it may be assumed that a fair start had been made in the introduction and growth of many varieties of fruit trees.

After Van Riebeek came the Van der Stels, father and son, and they were even more enthusiastic in the matter of tree planting of all kinds than was the former Governor. In fact, under their rule, tree planting became to some extent compulsory for the Colonists.

Then in 1687 came the Huguenots from France, and an impulse was added to the already awakened interest in all matters connected with the growth of fruit trees and vines. Under our favourable conditions, the fruit produced equalled, and in many cases excelled both in size and quality, anything ever seen in the homeland, and the enthusiasm of the combined Dutch and French population resulted in the planting of many vineyards within the confines of the areas now known as "The Western Province of the Cape."

Apart, however, from the culture of the grape and its products of Wine and Brandy, there was nothing to induce the planting of Orchards on any kind of a commercial scale. Communication on land was confined to ox-wagon and by sea, the few ships calling at Cape Town could only, in those days of sailing vessels, take sufficient fruit for their own needs; it is easy to imagine, however, that each calling ship would carry away every possible ounce of fruit obtainable. The position of the Cape, a sort of half-way house between Europe and the East, with its fine climate caused it to become a kind of health resort for invalids returning home from both British and Dutch Possessions. There are, at the present day, many descendants of those who sojourned there temporarily, and afterwards returned to enjoy the South African climate and make their homes here.

The innate love of Horticulture and Viticulture possessed alike by both French and Dutch is responsible for such development as then took place. One may see evidences of it in the many well-kept gardens, orchards, and vineyards all over the country, but more especially in the Western Province of the Cape, where Nature has lavished her gifts of climate seemingly for no other purpose than to assist the Horticulturist in his projects.

From the end of the seventeenth until the end of the nineteenth century, a gap of two hundred years, is a long time, and until the termination of that interval small encouragement or opportunity was afforded of developing anything in the way of a Fruit Industry. No markets, with the exception of the extremely limited local ones in the Colony, were available and so no inducement existed for commercial planting.

It must not, however, be supposed that there was nothing done in the way of growing fruit. The domestic garden, not the commercial orchard, was the centre of interest, and rivalry was undoubtedly as keen then as it is now with regard to the possession of the best, finest, choicest, and prettiest varieties of flowers, grapes, and fruits of all sorts. By such means, interest in fruit growing was not only maintained but intensified, so that when the Diamond Fields of Kimberley were opened, the first market of any note was found outside Cape Town, and interest was gradually displayed and developed in the planting of Orchards as railway facilities were made available.

The Johannesburg gold fields at a later date began to attract attention, and with the opening of the railway from Cape Town to the Transvaal in 1892 further inducements were offered to the Orchardists of the Cape in the shape of good markets where there was a demand for their fruit at profitable prices.

Steamship communication between South Africa and England

had developed rapidly, and towards the close of the nineteenth century the first shipments of soft fruits had been made from Cape Town to London, with, on the whole, encouraging results. In the year 1900 the total export of fruit from South Africa to England was 309 tons and consisted of Plums, Pears, Peaches, Nectarines, and Grapes.

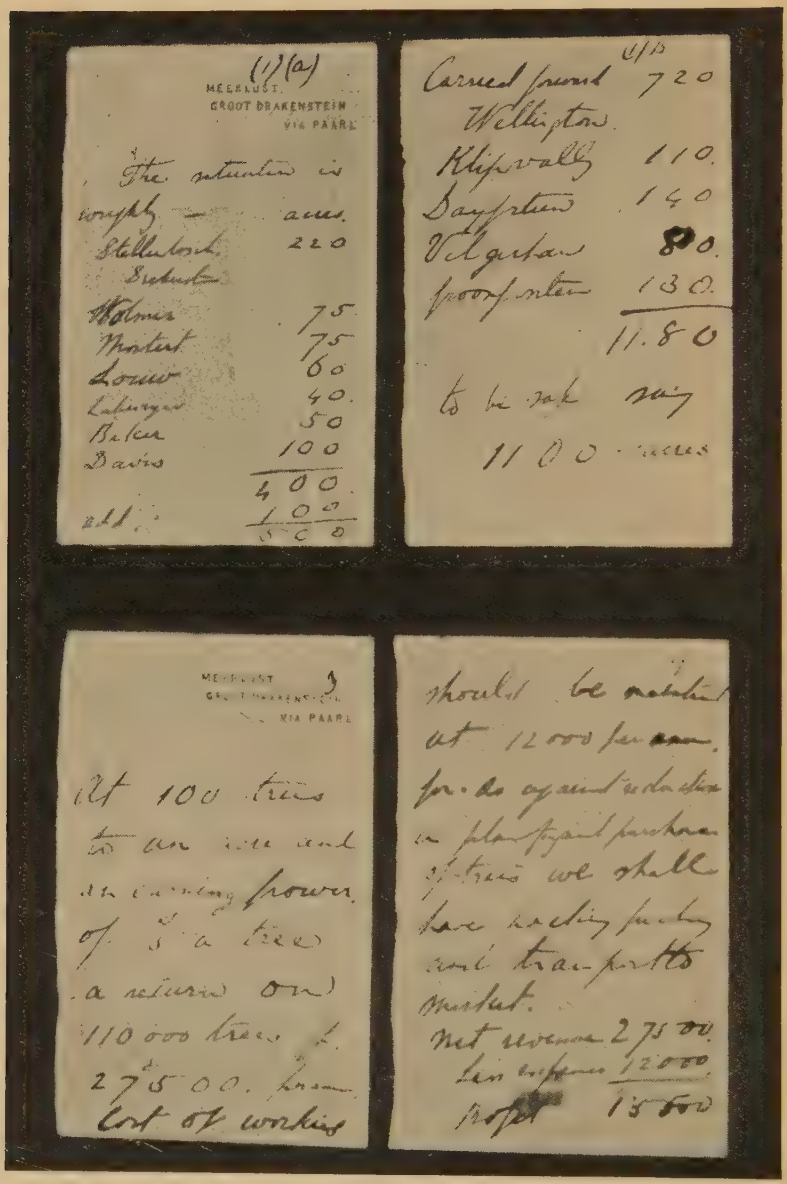
An event which had a great bearing on the development of the Fruit Industry in South Africa was the arrival in this country of Mr. H. E. V. Pickstone from California. He had previously been in South Africa in a military capacity, and had recognised the enormous possibilities which awaited the fruit grower. After securing a sound knowledge of the nursery business in California he returned here, and arrived in 1892, when he at once started to take an active interest in fruit matters generally.

Without attempting to follow the career of this very successful nurseryman and fruit grower, it may be said that he was instrumental in interesting the late Cecil John Rhodes in the business of fruit growing. The time was propitious, large numbers of vineyards had been destroyed by *Phylloxera* and the use of the American resistant vine as a stock had not become general. As a consequence the vine-growing industry was at a low ebb, when Mr. Rhodes stepped in and purchased some twenty-five of the best farms in the Paarl, French Hoek, Stellenbosch, and Wellington districts, with the avowed object of starting a new industry in South Africa. How well he succeeded is now apparent.

One of his first steps was to send to California for skilled orchardists to come over to commence operations, and, amongst them, the author was one. The accompanying fac-simile copy of a letter written by Mr. Rhodes to Mr. Pickstone is interesting as showing the time and forethought which he devoted to the institution of what, to him, was after all merely a side line.

The venture known as "The Rhodes Fruit Farms," together with "The Cape Orchard Co." under the auspices of Messrs. Malleson and Dicey, were amongst the first to demonstrate that it was possible, not only to grow fruit of good quality at the Cape, but also to export it at a profit. The examples set were followed by neighbouring farmers, and from the small beginnings made at the close of the nineteenth century, the fruit-growing industry has grown to such an extent that in 1925 the export of deciduous fruits only amounted to over 1,000,000 boxes and in the present year, 1928, it is anticipated that an equal number of boxes of Citrus fruits will be sent away.

The industry and its natural offshoots in the way of canned and dried fruits may now be described as being well established, and this is almost entirely due to individual enterprise. It is true, also,



FACSIMILE OF THE LETTER WRITTEN BY MR. CECIL RHODES TO MR. PICKSTONE, STARTING THE CAPE FRUIT INDUSTRY.

that Government assistance has operated to some extent in a manner favourable to the fruit grower.

For instance, at the Cape the Elsenberg College has grown an Orchard for Experimental purposes which is now some thirty years old, and this has furnished material for the instruction of hundreds of students. A similar institution exists on a much smaller scale at Middelburg in the Eastern Province of the Cape and at Bathurst.

Work of an experimental nature has also been undertaken in Natal at Cedara, Weenen, and Winkel Spruit.

In the Orange Free State at Glen, Twee Spruit, and Groot Vlei, and in the Transvaal at Potchefstroom, Zeerust, Ermelo, and Warm Baths.

It is true that, in the Agricultural Department of the Union, there is a Division called "The Division of Horticulture," but it has never had sufficient financial support to enable it to fulfil one-fifth part of the work it should have undertaken. In fact, it may be said that the Division has been starved.

Governments have, however, through the Railway and Post-Office Departments been of some assistance to the fruit grower. The latter department has endeavoured to secure beneficial rates on fruit sent oversea when it has been arranging its mail contracts with the Union Castle SS. Co., whilst the former department at the commencement of the Orange Export Industry granted most favourable rates on all fruit for export. In the case of both rail and sea freights to-day, prices are far higher than they were.

The industry has spread over each province of the Union, and naturally matters have developed on common-sense lines. The coast line and warmer parts of Natal, Transvaal, and the Cape have become centres for Citrus culture. Some of the hotter parts are fitted for the production of fruits of an almost tropical nature. The Free State and High Veld of the Transvaal produce excellent Apples, while the Western Province of the Cape is pre-eminent in the production of Stone fruits.

Many thousands of Citrus trees have been planted throughout the Union and a very large share in this development may be attributed to the sale of orchards on the easy payment system. A capitalist or company secures a large tract of suitable land and cuts it up into tracts of five or ten acres to be sold and maintained until the trees come into bearing for a possibly higher figure than an individual could purchase the same land, but with the advantage to the purchaser that payments are spread over a term of years.

Similar developments have occurred in the case of the Apple and Pineapple. In the Transvaal very large acreages have been planted to Apples, whilst in the Eastern Province of the Cape the largest Pinery in the country came into being under similar circum-

stances. Thus, large areas have been devoted to the Orange, Apple, and Pineapple. There is much to be said both for and against this system. Given good land, sound, expert management, efficient administration, and moderate overhead charges, such enterprise should be satisfactory to all parties. When, however, the land is not all that it should be, the management not efficiently conducted, the administration unsound, and the whole scheme simply originated and carried out on a money-getting basis—then the " plot system " may be regarded as entirely detrimental to the fair fame of South Africa and unsatisfactory to the last degree.

Sound plot schemes have done much towards the development of the fruit industry of South Africa. They have brought under cultivation thousands of acres of raw veld or bush land, and made them profitable, whereas, had it not been for such schemes, the land would have remained of little or no value. By means of this system many thousands of natives and hundreds of whites have been provided with the means of livelihood, whilst large sums of money are annually brought into the country in exchange for the produce they export.

Incidentally, the development of the fruit industry has had, in the past, and will have to a far greater extent in the future, very considerable influence on the population of our country and its character. It has brought hundreds of men of good stamp here, in many cases with families also, and the result of this influx will be apparent in future generations.

Fruit growing in the past has now been touched on. The industry of the present consists in the supplying of our local markets, the export of fruit of all sorts, Canning, Jam-making, and the dried fruit industry.

As far as our local markets are concerned, whilst it is true that large quantities of fruit are consumed annually in South Africa, our consumption is totally inadequate to account for more than a fraction of the entire output. It may therefore be stated that our fruit business, in whatever form it may take, is very largely dependent on an export trade, and the future expansion of the industry, therefore, rests in that direction.

Very few realise the amount of money brought into this South Africa of ours annually by the sale of fruit. It is almost all English money, though a little does come from other sources. However, the export of fruit will be dealt with later.

It is certain that the fruit industry will continue to expand and equally certain that it will be necessary to further develop our overseas markets in every country north of the equator. On the initiative of our business men, acting in conjunction with the growers, the future success of our industry will depend.

CHAPTER II

CLIMATES OF SOUTH AFRICA

A VERY wide range of climates is to be found within the borders of the Union of South Africa. This is not surprising when one considers the vast area of the country and its varying altitudes. The topography of the sub-continent may be regarded as a series of steppes. Mr. C. Stewart, the Chief Meteorologist of the Union, thus describes it:

"1. The coast plateau or coast flats, having an average elevation of 500 to 600 feet and varying in width from about 30 miles in South-West Africa to three or four or even less in the South-East of the Cape Province.

"2. The Southern or Little Karroo, a narrow tableland about 15 miles in width, crossed from east to west by a series of parallel mountain ranges separated by narrow valleys. Its average elevation is about 1500 feet and it is separated from the coast belt by the Langeberg and Outeniqua mountains.

"3. The Central or Great Karroo has an elevation of between 2000 and 3000 feet. It is bounded on the west by the Cedarberg and Bokkeveld and on the south by the Witteberg, Zwartberg, and Zuurberg ranges.

"4. The Northern Karroo or High Veld is the innermost plateau comprising the greater part of the Cape Province, the Orange Free State, and the greater portion of the Transvaal. It is encircled on the west, south, and east practically from the Limpopo to the Orange River by the mountains of Namaqualand, the Roggeveld, Winterberg, Stormberg, and Drakensberg ranges, constituting the Great Escarpment. This plain has an elevation of about 4000 feet, rising in the north-eastern portion to 6000 feet in the Transvaal High Veld, and 10,000 to 11,000 feet in Basutoland, and forms the main watershed of the country.

"Outside these areas lie the Transvaal Low Veld, Swaziland, Zululand, Natal, and the Eastern Uplands of the Cape Province, the native territories of the Transkei, the mountainous south-west including the Cape Peninsula and the west coastal area. The greater portion of South Africa has an elevation of over 3000 feet, whilst the area below 1500 feet consists merely of a narrow fringe round the coast."

Temperatures naturally ascend as the elevation descends and become lower as the altitude increases, thus there may be found in some part of the Union a climate suited to the production of practically every kind of fruit tree which grows, with the exception of purely tropical varieties.

The mean normal temperature of the Pacific Ocean near the coast of California ranges from 50° to 60° (Wickson's "Californian Fruits") and has considerable influence on the climate of that State. The mean annual temperature at Cape Agulhas, S.A., is 61·5° F. at an elevation of 55 feet above sea-level, that at Johannesburg is 60·6° at an elevation of nearly 6000 feet. This is due to the compensating influence of latitude. Our coastal climates vary to some extent, the area from Northern Zululand on the east coast to Namaqualand on the west for the first few miles inland is frostless. The eastern portion of the coast line, down as far south as Port St. Johns and possibly East London, may be described as humid and equable at all times of the year, whilst from Mossel Bay round the east coast to Namaqualand the climate, owing to the presence of the cold west coast current, is decidedly cooler.

The rainfall in these areas varies considerably. Parts of Zululand and Natal have an average fall of 40 to 50 inches. Practically the whole of the coast thence, right round to the Western Province of the Cape, gets from 25 to 30 inches, whilst the Western Province itself may get anything from 15 to 50 inches, depending on local conditions. The precipitation in the vicinity of Cape Town takes place during the winter months, and this is the only portion of South Africa where this occurs. Hail may be said to be a rarity throughout the whole of the coastal area.

The districts from North Zululand south to St. Johns may be described as sub-tropical and of equable climate. Within their limits the culture of fruit trees sometimes classed as Tropicals is carried on. The mango, avocado, litchi, banana, pawpaw, etc., are somewhat widely grown, though the total acreage under these fruits is by no means large.

Continuing with the topography of the country as described by the Chief Meteorologist, it may be said that the Southern, or Little Karroo, has no outstanding features of interest to the fruit grower excepting in such portions as may be, owing to the conformation of the mountain ranges, somewhat amenable to coastal influences; where such are found the culture of citrus fruits, pine-apples, and vines may be carried on.

The Central, or Great Karroo, which embraces a very large portion of the Cape Province, has an altitude of about 2500 feet on the average, and temperatures range from extreme cold in winter to over 100° F. during the summer months. Frosts occur over a

very large portion of the Karroo from 50 to 200 nights throughout the year, and in one or two districts have been known to occur every month throughout the year. Rainfall runs from under 5 inches in a few parts to some 20 inches in others, the larger portion having an average of from 10 to 15 inches, the whole of which generally falls during the summer months. Hailstorms occur, but are by no means common. Under such conditions the culture of citrus fruits in this area is very small. Considerable attention has recently been given to the culture of stone fruits in the eastern portion, where the long, warm, sunshiny days have a marked influence on the colour and ripening of the fruit.

Grapes of a very fine quality are grown in the Graaf Reinet district. Where fruit culture is possible in this area, there are some features decidedly favourable to the grower, such as the comparative freedom from troubles of a fungoid nature, to which the dry hot air is inimical.

The Northern Karroo, or High Veld, comprises portion of the Cape, the whole of the Free State, and the High Veld of the Transvaal. The average altitude is about 5000 feet with the exception of Basutoland, where double that elevation is sometimes reached. Rainfall occurs principally during the summer months and may average 25 inches per annum, more or less. As may be expected, frosts are common over the whole of this area, but are not of such long duration as in the Karroo proper, lasting from 50 to 150 days only. Snow falls over many portions of the Transvaal and Orange Free State, and persists towards Natal and Basutoland, where the mountains are snow-capped for months at a time. Electric storms accompanied by hail are common throughout the summer months on the High Veld. Occasionally damage is done to fruit crops; as a rule this is confined to clear-cut "strips" of country, and whilst on one side of the road the storm may be violent, on the other little or no hail may fall. The older population have a theory that there are certain well-defined "hail belts," and it is, of course, an axiom to keep away from such parts. Although more or less damage to crops is by no means a rare occurrence, there has not been any diminution in the setting out of orchards, so that danger from hailstorms is not regarded as being a complete deterrent to successful orcharding.

In addition to the areas already dealt with, there are in the Northern Transvaal many thousands of acres of land which are entirely frostless, usually termed "Low Veld"; it has a rainfall of from 30 to 50 inches and over, and is similar to the coastal areas, but with a drier atmosphere. These districts are well suited for the growth of different kinds of citrus fruits, mangoes, bananas, avocados, and litchis. Hailstorms in these areas are of rare occurrence.

Natal, in addition to her share of the coastal section, has a hinterland which runs up to the Transvaal border and has a large High Veld area, termed in that Province the "Highlands," and these are subject to the climatic influences mentioned under that heading.

It has been stated that the development of the fruit industry of the Union proceeded on common-sense lines. That statement requires perhaps some slight modification. After all, the industry is only a young one compared with fruit growing in other countries and is still in its early stages. A result has been that varieties of trees have been planted here and there which for some reason or other have refused to grow and bear fruit. Others will grow and not bear. Certain kinds of peaches will not bear in the Low Veld. Some varieties of apples will thrive on the High Veld and not near the coast, and *vice versa*. The eventual decision as to what varieties are to be regarded as entirely suitable to certain localities will depend on the result of work of an experimental nature, and until that is completed no hard and fast statements should be made, excepting, of course, in those instances where something definite has been arrived at.

Speaking generally, it may be said that the High Veld is more suitable for the apple and pear than for stone fruits of most kinds, on account of the lesser susceptibility of those trees to damage from frost. Both the apple and the pear are, however, fruits which have a very wide range, and it is therefore no wonder that they each attain a great degree of perfection in the Western Province of the Cape at an altitude of 400 to 600 feet only.

Stone fruits, though grown to perfection of flavour and colour on the High Veld, are not regarded as so reliable there as in the Western Province of the Cape, on account of possible damage from frost and hail. The Pomelo, of the citrus family, whilst bearing profusely in the interior citrus areas of the Transvaal, only produces fruit of the highest quality when grown near the sea or some large body of water sufficiently extensive to saturate the atmosphere with moisture.

That climate materially influences the period of ripening is without doubt. Cape peaches of the Alexander type are sometimes early enough to catch the Christmas market in London. In the Free State and the Transvaal, on the High Veld, peaches of the same varieties ripen ten days earlier. This is partly due to climate, the brighter sunshine and higher temperature at that period of the year being more to the liking of the tree than the heavier and more foggy atmosphere at the coast.

Apart from the direct influence exerted by climate on the ripening of fruit, it is a common remark that fruit trees in South

Africa, and especially in parts of the Low Veld, do not get enough rest. They are constantly at work, producing either leaves, wood, or fruit. There is much truth in this statement, and it ought to prove an incentive to growing the right trees in the right places, or as nearly so as possible. Some years ago the author sent peach, plum, and other fruit trees to Nairobi, Kenya Colony, for the Agricultural Department there. Reports as to their behaviour went to show that these poor trees did not know what to do in their new surroundings; they had blossoms and fruit in all stages on them all the year round. Under such conditions as these, no trees can be expected to give of their best, and so there is little doubt but that the study of climate with regard to the varieties of fruit trees which are to be planted in any specified locality is one which would amply repay the grower. Apart from the growth of the tree and the early ripening of the fruit, we in Sunny South Africa have to thank Old Sol for other matters in connection with the production of perfect fruit specimens. Probably no country in the world enjoys a greater number of hours of bright sunlight. The subjoined further extract from the report of Mr. Stewart, the Chief Meteorologist, is given in support of this statement.

MEAN DAILY HOURS OF SUNSHINE.

Month.	Cape Town.	Kimberley.	Johannesburg.	London.	Calcutta.	Baltimore.	New York.
	Hours.	Hours.	Hours.	Hours.	Hours.	Hours.	Hours.
January	9·71	9·00	7·8	1·4	8·9	4·9	5·1
February	9·78	9·14	7·5	1·8	9·0	6·4	6·2
March	8·36	8·83	7·2	3·4	9·5	6·8	6·5
April	6·50	8·72	8·7	4·6	9·9	7·9	7·7
May	6·10	8·64	8·8	6·5	9·4	7·7	8·1
June	4·81	8·64	9·0	6·2	5·1	9·2	9·0
July	4·90	8·90	9·2	6·3	4·1	9·2	8·4
August	5·93	9·23	9·9	5·9	3·6	8·4	8·3
September	6·76	9·78	9·3	4·3	5·3	8·4	7·5
October	7·92	10·08	9·0	3·1	8·3	6·7	5·8
November	9·16	10·76	8·9	1·7	8·5	5·0	5·0
December	10·17	10·20	8·6	1·1	8·1	4·9	4·9

The above are the average number of daily hours of bright sunshine experienced in each month at Cape Town, Kimberley, and Johannesburg in South Africa with those experienced in four other cities.

Comparing temperatures between South African fruit-growing districts and those devoted to a similar range of fruit in California, we get the following.

Average summer temperature at various points in California

(taken from Wickson's "California Fruits"). San Jose 67, Hollister 66, Sacramento 72, Auburn 75 (deciduous fruits).

Mean maximum temperature in warmest month at different points in deciduous fruit areas in South Africa (taken from Mr. Stewart's report). Groot Drakenstein 84, Worcester 86, Johannesburg 79. The percentage of bright sunshine in the Western Province of the Cape during summer is of the greatest assistance in all matters connected with the harvesting of the fruit crop.

It is gathered in dry weather, and where out of doors fruit drying is carried on, the rays of the sun are responsible for the drying process. Grapes are gathered both for export purposes and for wine-making under perfect conditions of hot, dry sunshine, whilst in the Transvaal, Natal, and the Eastern Province of the Cape, where the citrus industry is the salient feature in the world of the fruit grower, similar conditions exist during the winter months, and the fruit is picked, packed, and exported under the most perfect climatic conditions.

The acme of perfection of climate has been reached for the handling of both citrus and deciduous fruits.

Rainfall has a very important bearing, apart from the question of provision of moisture in the soil, on orchard yields. Continuous rain during blossoming time interferes with the distribution of pollen from the blossoms, and as pollination of a successful nature cannot be effected the result is a meagre yield of fruit.

Winds are by no means to be ignored by the fruit grower. This is notably the case in the Western Province of the Cape, where the "South Easter," or, as it is called locally, the "Cape Town Doctor," is a regular annual visitor. As a rule these winds commence towards midsummer and may last fitfully for three or four months, depending on the season. Orchards planted in safe positions, or well sheltered by windbreaks, always come off best on these occasions. Further north, winds of more or less frequency occur, principally during the months of August, September, and October, and though they are not on the whole as violent as the Cape "South Easter," it is necessary to be careful in the selection of an orchard site.

CHAPTER III

FRUIT SOILS OF SOUTH AFRICA

The division of areas referred to in the last chapter may, to a certain extent, be observed in connection with our soils.

A large portion of the coastal belt may be set down as having a preponderance of light sandy soils.

Those of the Little Karroo are of a slightly heavier nature.

The Great Karroo, with its immense area, consists very largely of deep alluvium and silt deposits with occasional calcareous patches, and the High Veld, embracing a large portion of the Orange Free State and the Transvaal, may be said to possess 50% of deep red, loamy soils varying in texture from light sandy to heavy clay.

The Transvaal Low Veld, Swaziland, and Zululand, with parts of Natal, include some of the richest sedimentary soils we possess.

Just as we have climate conditions which are suitable for the production of all kinds of fruit trees, so we have soils of every description, and they are so distributed by nature that they lend themselves to the perfecting of the fruit we ask them to grow. Take, for instance, the wonderful stretches of deep red loams, ranging from 6 to 60 feet in depth, which constitute the bulk of our citrus-growing areas, they are so located as regards climate that it would be impossible to improve the situation.

The lighter red sandy loams to be found round Johannesburg, often containing a stratum of quartzite gravel, producing perhaps the choicest early peaches in the world, are so situated climatically that it is doubtful if any improvement could be made (with the exception of the abolition of hailstorms). The pear revels in the heavier of the Cape alluvial soils in a climate unequalled, whilst plums and prunes of all kinds are equally well suited as to their requirements both of soil and climate.

It is this fortunate combination of circumstances which has given in so many instances due cause for the chorus of admiration with which our South African fruits have been received overseas.

Our soils may be grouped in the following order: sandy, sandy loam, loam, clay loam, clay, turf, and gravelly, as far as their mechanical composition is concerned. Their chemical constituents

divide them into what we call sour soils, brack, humus, and calcareous.

Sub-soils may contain pot clay and hard pan, which may be composed of the former or of other impervious substance, such as iron stone gravel.

We have a wide selection of soils and the fruit grower should endeavour to make himself acquainted with them from all view-points. He requires deep soils for the retention of moisture; if easily friable, so much the better. There is all the difference between stiff clay soils which are hard to work and others of lighter texture. Light soils for certain kinds of trees to grow in, and heavier and stronger for others. They must all be of reasonable fertility and contain a certain proportion of each of the different constituents which go to the production of a perfect tree on which perfect fruit is to be grown. There must be little brack; if soils are sour, then the acidity must be corrected. The mechanical condition of the soil is most important, and has a distinct bearing on the success or otherwise of an orchard undertaking.

Some soils are refractory, and this is specially the case of the breaking up of new land. They may require to be worked at precisely the right time after rain, or they bake and become unworkable. Many of these requirements the orchardist will have to learn from experience, and especially in the last-named instance.

Oftentimes the beginner will be at a loss to know just what is the best root to plant in his soil. Frequently a lack of knowledge of soil constituents is likely to exist. Under such circumstances he will naturally have recourse to the facilities provided by the Agricultural Department for soil analysis, and samples may be sent to the nearest school of agriculture for the purpose. Directions as to how the samples should be taken are provided by the institution to which they are consigned.

Sandy soils may be, and often are, quite profitable sites for orchards. Generally speaking, they cannot be described as rich, and in order to maintain fertility it is necessary to resort to manures of various kinds. Stable manures and cover crops of some legumes are of the greatest assistance, as they produce humus, which fulfils a good many useful purposes in soil economy. Apart from the actual good received from these manures as fertilisers, one of the chief benefits derived is that they render a sandy soil capable of retaining moisture for a much longer period than would be the case without their use. Although most soils of this nature are poor, they possess from their physical composition and lightness a distinct advantage over many heavier soils, in that the roots of plants and trees are able to penetrate them with ease and thus extend their feeding range to a far greater extent than would be the case in a

clay soil. Thus the fertility of a sandy soil may be said to be due to its physical conditions to a large extent. In the South-Eastern Transvaal there are numerous citrus orchards established and flourishing in soils of this nature.

Sandy loams are heavier than plain sandy soils; the extra loaminess assists in the retention of moisture to a far greater extent than is possible in a soil of a purely sandy nature. Loam itself may be described as a fairly rich earth, usually dark in colour, being brown, red, or black, as the case may be. Loam, as prepared by gardeners of the old school, consisted in a compost obtained from rotting, grass-covered turf, cut into squares and piled into heaps, one turf on the other, grass side downwards. After the grass had rotted the whole was dug over, mixed together, and called loam.

Loam represents a medium line between a sandy and a clay soil, and may be regarded as the one class of soil in which nearly all plants will thrive. A sandy loam then is really a form of loam with an admixture of sand sufficiently large in volume to affect the texture of the whole. Such soils are of good porosity and easy to work, being little subject to surface baking from the heat of the sun's rays after rain.

Loams—the description of the gardener's loam conveys the general idea expressed in the word. It covers good quality soils of medium texture, neither light nor heavy and is a term very generally in use in the composition of soils. It is recommended as suitable for all farm crops, including orchard trees of every description. There are some kinds of trees which prefer lighter soils, as the peach, and others, as the apple and pear, which may do better on soils of a heavier nature, but a good medium loam may be regarded as a pretty safe soil in which to plant most kinds of trees.

Clay loams come next to the free loams on the heavier side, on account of the presence of a certain amount of clay in their composition. As a result of this, the clay loams are not as easily worked as either the sandy or free loams. The surface is liable to bake after rain, and some judgment is necessary as to the right time for ploughing, cultivation, etc. These soils, whilst not as readily permeable by rainfall, are much more retentive than those of a lighter nature. They are equally as rich as ordinary loams, and are less liable to "wash" in case of heavy downpours of rain. They are also more durable than the ordinary loam and likely to last longer without fertilising. Probably a fairly heavy clay loam suits many varieties of the apple and pear better than any other class of soil. Clay loams are more easily handled than an ordinary clay, and for most classes of trees having any weakness at all for clay soils they contain a sufficiency for their requirements.

Clay soils may be briefly dismissed as being of minor importance

to the fruit grower, whilst they may suit a few types of apples and perhaps some plum roots which do not appreciate soils of a lighter texture; they cannot be regarded as by any means indispensable. A clay soil becomes soft and plastic during rain and will bake into hard, brick-like lumps in the sun. No trees can grow properly on soil which is lumpy; the roots require actual contact with as many of the life-giving constituents which they need as possible, and for this reason it is important that a perfect state of tilth should be maintained in all orchard soils. Clay soils afford the least possibility of this; they tend to shallow rooting and are very retentive of moisture, so much so indeed that in some cases the root-hairs will rot from constant exposure to wet conditions.

Turf soils, of which there is a large acreage throughout South Africa, are in a class by themselves. The Californian " adobe " is the nearest approach to the South African turf soils that the author knows of. As a rule it contains a little more clay than our turf. Whilst most soils of this class are grey when dry and black when wetted, there are also red turf soils with all the characteristics of the black excepting the colour; these are, however, in the minority. Turf soils often prove extremely fertile and yield large crops of cereals, especially mealies, but are not looked on with favour by the orchardist. They require as careful handling as a clay soil to keep them in good condition; the plough must be put in just at the right moment after rain—not too soon, or the result will be clods hard to harrow down to any degree of fineness, nor yet too late, or it may prove difficult to plough at all. When caught at the psychological moment the ploughing goes easily and the land may be harrowed to a good tilth. In dry, hot weather deep cracks appear, and in wet weather it is hard work to walk through turf land, to say nothing of moving animals or implements, owing to its very decidedly sticky nature.

Gravelly soils are to be found more or less all over South Africa and there are instances of successful orchards being cultivated in land of this nature. They may be composed of a mixture of quartzite gravel and red sandy loam (best soil for the peach), of water-washed pebbles and sand or sandy loam, of broken shale particles, or a variety of other component parts. In each instance the fertility of such soil, and its capability of supporting strong, vigorous orchard trees, depends, not on the gravelly particles, though as these are gradually broken down they afford material assistance to the soil particles already present, nor yet entirely to such soil as may be present, but to a very great extent to the tillage to which it is subjected. With generous cover cropping and judicious fertilising, gravelly soils may be brought to such a state of productivity that they can support a profitable orchard.

Stone fruits of all kinds tend to earlier ripening in them on account of the heat which the gravelly particles retain after the sun has gone down. Soils of this class are always easy to plough (though they wear out lots of points and shares) and easy to maintain in good order. Further and most important of all is the fact that gravelly soils almost always have perfect drainage.

Sour soils, " sour veld " as the ordinary term has it, are distributed to a greater or lesser extent over the whole of South Africa. Probably they are more in evidence in the south and south-west districts of the Cape than elsewhere. Frequently consisting of light to very light grey sandy loam, they may still, by fairly heavy dressings of lime, be brought into condition for growing a certain class of fruit tree. Drainage is often necessary and then, when the depth of soils warrants it, plantings may be made of many kinds of stone fruits grown on peach roots and a few of the hardier apples and pears.

Brack soils are to be found in the Cape Province principally, though that area has no monopoly of them. They are not regarded with favour. Sometimes when suitably situated they can be reclaimed, but when stretches of land miles in extent and as level as a billiard table are found, without any possibility of drainage, their reclamation is next to impossible.

The term " brack " represents what is called " alkali " in California and may occur in different forms of salts such as " Glauber's," common salt, carbonate of soda, and others, none of which is a desirable acquisition. One may see filmy deposits of " white " alkali on the surface of the land in which it is found, and this may consist of either ordinary common salt or Glauber's salts. These are less harmful to fruit trees and vines than carbonate of soda or " black " alkali, which may be regarded as extremely injurious to plant life in all its forms. Naturally soils having a proportion of alkali patches should be avoided.

There are some kinds of trees which appear to suffer less from the presence of brack than others. Amongst the fruit-bearing kinds we may place first the olive, with the others following in order of their hardiness to this trouble, as fig, vine, almond, pear, apricot, and plum. It must be understood that the roots of each of these are meant, and not plums or apricots grafted on peach roots; all those referred to must be on their own roots. The peach, apple, and orange nearly always succumb.

The presence of brack in water used for irrigation purposes frequently occurs in localities which have a quantity of brack land in the vicinity. Continual irrigation with such water can only make matters worse. By means of deep drains and a plentiful supply of fresh water, it is possible by frequent flooding to wash

out the brack and so render the soil productive, but for this purpose the natural lie of the land must be such as to admit of the work being thoroughly done.

Black alkali can be countered by the use of gypsum when that is obtainable. The rise of brack in the soil may occur as a result of irrigation, even when fresh water is used, if there is no effectual drainage. Frequent irrigations tend to raise the level of the water table, so bringing the brack upwards to the surface.

Calcareous soils are not common throughout South Africa, but are to be found both in the Cape, Transvaal, and Free State Provinces in some quantity. Lime may be present, as it is, in the form of dolomite rock, in large quantities in the Transvaal and especially near Pretoria. It does not follow that soils even in its immediate proximity are provided with an abundance of available lime; the reverse is often the case.

Many Karroo soils are underlaid at anything from 1 to 5 feet and more in depth by a stratum of lime rubble, and this formation is not uncommon in other parts of the Cape and Transvaal. On soils such as these the success or failure of crops depends largely on the depth of soil which may lie above the lime. Thus on soils of this kind, 4 to 5 feet deep, citrus trees may be planted with success, whereas when only 2 or 3 feet are present failure is certain. No tree succeeds on calcareous soils as well as the vine, and the European varieties on their own roots give a more satisfactory showing than some of the American resistant sorts. Hard pan found beneath the surface of the soil at from 1 to 5 feet may consist of:

1. Clay of so heavy a nature as to be impervious to water.

2. Ironstone gravel of extremely close texture and very small particles, almost impervious.

3. "Oud Klip" or old stone found throughout Africa from the Cape to Cairo, this is not always impervious, but has a deleterious effect on the roots of most trees.

4. Plough hard pan, caused by the constant ploughing of the land at the same depth and so forming a hard plane over which the plough foot has travelled so often as to have worn down the soil to a smooth, hard surface.

On occasion, dynamite has been used to blow out holes in hard pan for the reception of trees, or perhaps after trees have been planted, to enable the water to drain away. Soils such as the above are not fruit soils, but the last condition, "plough hard pan," can be done away with by the use of a sub-soil plough and with all future ploughings at varying depths.

In the selection of soils for planting fruit trees, depth should always receive the first and closest attention. The deeper the soil

the longer lived will the tree be which is planted therein. One never finds very old trees on shallow soils. Deep soils provide plenty of room for the development of a strong root system on which the tree depends for its sustenance and moisture. All plant foods are taken up in solution and the deeper the soil the greater the chances of a liberal and continuous moisture supply.

Before deciding on the site for an orchard, it is necessary to know what lies beneath the surface. Hard pan makes the use of soils in which it is found out of the question with the one exception mentioned. In the deep red soils of a loamy or sandy loamy nature, such as are so prominent a feature over the northern portion of the Union, it is difficult to say where the surface soil ends and what we term sub-soil commences. Very little difference exists between the top soil and that found 3 or 4 feet from the surface and soils of this nature may be levelled for planting or irrigation purposes with impunity. There is less danger of burying the good top soil and covering it up with poor sub-soils.

The necessity for soil examination is chiefly for the determination as to what undesirable qualities may be found under the surface. It is a common practice to have a number of holes dug at intervals over the proposed planting area, from 4 to 6 feet deep; these reveal at once the presence of objectionable sub-soils or the reverse, and it is not a very expensive undertaking in South Africa to have this done. There are also such things as post-hole augurs which may be used to bore into the earth, bringing up a sample of all through which they penetrate. This is not such a satisfactory method as the digging of holes.

CHAPTER IV

THE NURSERY

The Nursery business in South Africa may be said to have started in earnest when the development of the fruit industry made a heavy demand for fruit trees.

Previous to this, which occurred in the closing years of the last century, there were a few established nurseries in the Cape and Natal, but business was conducted in a leisurely manner. The demand for fruit trees was but small and consequently the supply was equally so. Nurserymen confined their attention largely to ornamental trees and shrubs, roses, ferns, and flowers of all descriptions. The inception of what may be called modern nursery practice in South Africa dates from the arrival of Mr. H. E. V. Pickstone already mentioned, and the introduction of many of the most popular and successful varieties of fruit trees from California, which State, even at that date, had established a leading position as a first-class fruit-producing country. He brought with him the French prune of commerce, many varieties of peaches, apricots, plums and apples and pears in large numbers, the selection of which was discussed with the author, prior to Mr. Pickstone leaving California for this country. It is not proposed to follow the fate of many different varieties introduced, some were a great success, others failed, but it may be stated definitely that with his arrival the nursery business, as far as the production of young fruit trees is concerned, took on an entirely different aspect.

A nursery is just as necessary for the successful raising of young trees as it is for raising young children. Each are at the beginning of life, and on nursery treatment depends to a great extent the future health and strength of both trees and human beings. Both are young and tender and require lots of care in rearing, and for this reason, in the case of a nursery of fruit trees, the selection of a site is of considerable importance.

It may be mentioned here that the average tree produced in South African nurseries compares most favourably with the best average trees turned out in any other country in the world; in fact, to put it quite plainly, the author regards South African nursery stock, *when grown by a competent nurseryman*, as second to none.

The climatic conditions under which many of our nurseries are conducted are far superior and in advance of those to be found in any other country. Natal and the Bush Veld and Low Veld of the Transvaal are ideal as producers of citrus and sub-tropical trees of all kinds, whilst the Western Province of the Cape has always grown the best and finest trees of a deciduous nature and still continues to do so, notwithstanding that vigorous competition exists from other parts of the Union, both in the Cape and Transvaal.

These favourable conditions in conjunction with the wise selection of positions in which to set up a nursery business tend to the raising of trees of a vigorous and healthy nature. The choice of stocks, methods of propagation and treatment of the trees in the nursery are in the hands of the nurseryman himself, and it may be pointed out that he should be a man of experience who has served an apprenticeship to the work and been properly trained in each of the steps necessary to the final production of a first-class article.

Questions are frequently asked with regard to the suitability of trees grown in the Western Province of the Cape, with its winter rainfall, to those parts of the Union which have their rains during the summer months, and *vice versa*. Long and varied experience in this connection has shown the author that no difficulty is experienced with any trees of Western Province origin in any of those parts of the country where the rainy seasons are reversed.

The principal objects to be sought for in order to secure the most propitious site on which to start a nursery are, suitable climatic conditions, neither too hot, nor too cold in winter, the latter to be especially looked out for in the case of citrus and other trees requiring a frostless climate during their growth; the right soil; a good water supply; shelter from high winds and cold air currents; perfect drainage and a north and eastern exposure.

The best nursery soils are composed of a sandy loam. A very large selection of these are present in the Union. The silt deposits found along river banks also provide excellent soils for a nursery. Those to be avoided are the clay loams, turf, and heavy clay.

It is necessary that growth in the nursery should be fairly but not unreasonably quick, and the lighter soils lend themselves nicely to this. It is unwise to plant young trees in heavily-manured nursery lands; on removal to ordinary orchard conditions with a poorer soil the tendency is for the trees to remain inert for some time previous to starting to grow; for this reason it is not advisable to enrich nursery soils to any considerable extent, but rather to rely on careful cultivation and a moderate use of irrigation water and a soil of medium quality for the production of a good nursery tree.

The water supply must be unfailing and capable of being led by

gravitation to the required spot if possible. All pumping of water costs money, and although it may be urged that a well-conducted nursery should be able to afford to pay for pumping the necessary water, it is just as well, if it can be managed, to secure a supply which will cost next to nothing either for lifting or distribution. The use of " brack " water should be carefully avoided.

Shelter from high winds and cold air currents is very necessary for a successful nursery. Trees grow better, more shapely and more quickly if they are not at the mercy of every wind that blows. It is all very well to say that a little wind is good, that it hardens the tree, etc. Young trees want to be sheltered and encouraged to grow out of their babyhood within a reasonable time and not to be kept back, hindered and perhaps stunted in their growth. For these reasons shelter must be sought for, either from some natural source, such as is to be found at the foot of a hill slope, under the protection of a mountain range, or it must be provided by the planting of windbreaks such as we see so often in use round orchards.

The class of tree to be used for windbreaks depends entirely on the climate in which the nursery is situated. If it is to be a nursery for citrus or sub-tropical trees, then quick-growing gum such as *Eucalyptus saligna* is about as good a tree as can be had. These may be planted round the nursery, and intermediate and smaller windbreaks of " dhol," which is a legume growing to a height of 10 feet and over in a very short time, may be set out between the different plots; the use of these two in conjunction affords a very satisfactory windbreak system. Should the nursery be situated in a colder climate and the propagation of pome or stone fruits be contemplated, other kinds of trees must be used. *Eucalyptus viminalis* forms a good outside protection, with *Cupressus macrocarpa* or *arizonica* to be used as intermediate shelters.

With protections of this nature the site for a nursery may be chosen with little regard to a natural protection from hills. At the same time it should be so situated as to be well out of the cold air currents which prevail at night time and are common to the smaller valleys. On large open spaces cold night air does not settle to the same extent, but possibly an occasional frost occurs.

In the case of deciduous nurseries, this is rather to be desired than otherwise. It does not affect the trees, as they are dormant at that period of the year, and, further, the absence of leaves makes the lifting of them all the easier.

No matter where the nursery is situated, the question of drainage must be regarded as an important if not a vital one. Well-drained soil is easily aërated, whereas soil which retains a quantity of water cannot be properly aërated and as a consequence the growth of

roots cannot take place. Undrained soil may be described as usually being cold and damp, as against warm and mellow, which are the requirements of a nursery soil. It is as a rule comparatively easy to select a site which is naturally well drained; it does not of necessity follow that it must be situated on an elevation, as many suppose to be the case. Very frequently land situated on the open veld is as well drained as that on the foothills. Sub-soil conditions are the determining factor. Should a situation be selected, owing to force of circumstances, which needs to be drained before planting, there are different methods of doing this, which will be dealt with under the chapter "Laying Out and Planting."

The nursery should if possible have an exposure to the north and east. This gives the trees the benefit of the early morning sun.

Many nurserymen in South Africa still practise the trenching of all land set aside for nursery purposes. The author has conducted nursery work over a very large portion of South Africa and has invariably found that trenching, although expensive work, pays in the long run. Trees grow better, stronger, and more quickly.

Ploughing to a depth of 12 inches followed by the use of a sub-soiler is not an unsatisfactory method and comes next to trenching, or "dolving," as our Dutch friends say. It is, however, exceedingly unwise to attempt to plant a nursery on any ground without an extra deep ploughing. The planting of a crop of Kaffir or Velvet beans the previous season in September and the turning them under in about January or February is a good way of affording a little extra nitrogen and humus to the soil, and very marked results are obtained when this is done. When soil for nurseries is trenched, it is not either advisable or necessary to trench quite as deeply as when land is being prepared for a vineyard. Eighteen inches is deep enough. This work benefits the mechanical condition of the soil more effectually than anything else. There are, or should be, no clods left, the soil particles are reduced to extreme fineness. The whole is aërated and thus air, earth, and water, which are necessary to the formation of a fruitful soil, are rendered available for the use of the tree roots.

Propagation from Seeds.—With the exception of the apple, all our fruit trees in South Africa are raised by means of planting seeds. This is nature's own way, and cannot be improved on for the production of a healthy tree. The peach root is used more extensively as a stock for stone fruits than any others; on it plums, peaches, apricots, nectarines, and even almonds are budded. Peach seedlings are therefore more in request than any others for propagation purposes. They should be grown from fruit borne by selected, healthy trees on land free from root gall. Occasionally

this is done. More frequently a lot of pits are purchased from a local drying or canning establishment and set out in beds. What is known as the St. Helena Peach or the Transvaal Yellow is a favourite for the production of peach stocks. It is certainly the hardiest peach in South Africa and pits of them are always in demand for propagation purposes.

Seeds of the Christmas or Myrobolan plum are planted to a limited extent, and also those of the Marianna, although plums are not used as stocks to anything like the extent they formerly were. The peach almond is used to a limited extent in the Cape Midlands as a stock on which to bud any stone fruits which may be intended for planting in " brack " land. Methods of treating these in the nursery are the same as those adopted for the peach. Seed should be collected and stratified before it has time to dry out. Stratification implies the placing of a layer of pits at the bottom of a shallow hole of any convenient size (for very small quantities a wooden box may be used) and the placing of alternate layers of sandy soil and pits one on the other until the hole is filled and the level of the ground reached. The hole should then be covered with long grass or litter of some kind and kept moist until the seeds start sprouting in the Spring. They are then taken and planted in nursery rows about 4 feet apart by 9 inches apart in the rows and allowed to remain until the time comes for budding. The rows of seedlings are kept clean and free from weeds, the land is irrigated and cultivated and then at the expiry of six months or so they should be ready for budding. Seeds planted out in August should be ready to bud the following February.

It is customary to stratify and plant the seeds just as they come from the fruit, but sometimes the practice of cracking the shells is followed. Very little difference in the germination is noticed if the pits have been continually kept moist, but if for some reason or other this has not been done, then the cracking of the shells appears to have some advantages.

Pear trees are also raised from seed. Until recently large numbers of pear seedlings were imported from France annually, and small success was met with in the attempts to raise them from seed in South Africa until it was demonstrated by the Horticultural Division of the Agricultural Department that it could be successfully done by soaking the seeds for some time before planting, either in cold or hot water. Seeds placed in cold water and allowed to remain for six days should give about 80% germination. When hot water is used it should be poured over the seeds at some degrees less than boiling point, and allowed to stand for 24 hours from the time of immersing them. Good success is met with by the use of this system.

The type of pear seed used is, as a rule, *Pyrus communis* and this is also imported, but recently seeds of some strong growing pear such as Keiffer or Le Conte have been used. It is too early to make any definite statement as to the reliability of these for stock purposes. There are also a number of new types of pears under trial, chiefly of Japanese or other Asiatic origin, both in this country and America, which may prove very useful as stocks. So far no conclusive statements have been made as to their suitability or otherwise for South African conditions.

Pear seeds are planted out in a seed bed which should be composed of light sandy soil and carefully looked after. Just sufficient water should be given to keep the little plants moist but not wet. Shading is not, as a rule, necessary, but in the hotter parts it may be resorted to with advantage. When about 6 to 8 inches in height they are transplanted into nursery rows, where they receive similar treatment to that meted out to peach and other seedlings.

Apples are propagated principally from the roots of varieties which are resistant to the attacks of the woolly aphis. This is vegetative propagation as opposed to the natural method of planting seeds. Its justification is that by the use of cuttings or roots of what are termed " blight-proof " varieties it is possible to produce a tree which shall be, as far as its root system is concerned, immune from the attacks of the woolly aphis. The various methods are mentioned in the chapter " The Apple." The layering of roots constitutes the principal source from which stocks are obtained, though the root graft and ordinary layers are still used, and both methods have their adherents.

Cherries are grown from seeds of the wild cherry of either the Mahaleb or Mazzard variety. Few, if any, are raised in South Africa, and this is not to be wondered at, as the cherry is not widely planted here, although it could be produced quite well in some parts of the country. As it is, such stocks as may be needed are imported from France. The growing of cherry seedlings is simple, the principal object being to keep the seeds moist from the time they are taken from the fruit until they are finally planted out in the seed bed. The young plants are not too quick growers and usually have to remain for two years in the nursery before budding.

Walnut and pecan trees are raised from seeds, and in order that the best varieties should be secured, the seedlings should be budded or grafted. Walnuts should be stratified in damp sand from the time they drop from the trees until they are planted, ripening from March to the end of April, according to locality. The nuts should be kept until the soil is warm about the following August. Many will have cracked, and growth may have started or be on the point of doing so. The rows should not be less than 5 feet

apart, and the nuts should be set out 1 foot apart in the row. Generally speaking, the walnut is rather slow growing in the nursery and requires to remain there for two seasons. Judicious watering and constant attention are necessary. Nuts should be planted about 2 inches deep.

Precisely similar methods should be used in raising the pecan, and chestnuts may also be grown successfully by following the same routine.

Citrus Fruits.—The orange, lemon, grape fruit, naartje, kumquat. Citrus trees of all kinds are best grown from seeds, though there are other ways of doing it, as will be shown. South African experience has decided that the rough lemon is the most satisfactory stock on which to bud most kinds of oranges, lemons, and grape fruit.

The sweet rough lemon appears to suit the naartje better than the sour, and the naartje budded on its own roots does exceedingly well, giving very satisfactory results. Grape fruit may be budded on to stocks raised from some vigorous growing variety, and there appears some prospect that this method will advance in favour. The rough lemon is, however, the favourite stock at present. The kumquat is probably more often budded on the *Trifoliata* orange than on any other root. On this stock it makes a nice compact tree and produces the best quality fruit.

Other methods of propagation are resorted to besides the raising of trees from seed. They consist in the use of ordinary cuttings, root cuttings and " inlayers," commonly called " layers." Layering has been used as a means of propagation in Europe and India for many hundreds of years, it has also been in use in South Africa for many generations. More recently, the visit of Dr. Webber, one of the highest authorities on citrus culture in California, has drawn a good deal of attention to that method.

It has the advantage of reproducing the identical variety needed without any possible means of variation, excepting from soil causes, which is not the case when trees are raised from seed and then budded with the desired scions of other varieties. In the one instance you propagate direct from the parent tree without any intervention from outside sources. In the other there is the past family history of the seed from which the stocks are grown, and in addition the past history of the trees from which the scions are taken. Heredity has to be taken into account and fixity of type is assuredly more possible when layering is made use of than when propagating from seeds is the method used.

Layering, however, is not a commercial proposition owing to the extremely limited number of trees which can be produced by this means. Had South Africa depended on layering as a means

of supplying all the orange trees she has planted during the past few years, it is to be feared that she would have been a very long way from her present status as an orange-producing country.

Layering is not a sound method of raising orange trees because of the liability of the sweet orange root to the serious disease known as " Collar Rot," its shallow rooting and very imperfect root system. It is quite true that oranges produced by the layering method do occasionally live for sixty years and over, but they are the exceptions and not the rule. An orange tree grown from a layer, to reach that age, must have had a good deal of luck and been situated in especially favourable circumstances. As regards water supply, too much would have caused disease, whilst too little would have been equally fatal to the constitution of the tree, owing to its inability, due to the shallow rooting system, to obtain moisture from a greater depth of soil.

The principal objects in using layers were, first, the ease, simplicity and economy with which the work could be done, and the very early fruiting of the trees. Dr. Webber noticed the fact that absolute uniformity of quality in the fruit can be assured by this method; and that certainly is one advantage to be obtained by layering. A particularly fine type of orange may be propagated with the knowledge that it will reproduce fruit identical with the parent type. That trees so produced will be more subject to disease than those raised in the natural way from seeds and subsequent budding is a certainty.

The method of layering is so simple and has been so often described, and is still so well known in this country, that it seems hardly worth while to mention it here, yet owing to the recently renewed interest created in the method it may prove useful to do so. Briefly, " inlayering," to give it the full word used, is undertaken as follows:—

1st. A good large tree with a record of bearing fruit of exceptional quality is selected as being a desirable one to propagate from. For the easiest way, it should have low-lying and widespread branches.

2nd. The selecting of the most suitable branches for layering, the cutting them half through, either with a sharp knife or saw at the proper distance from the tip of the branch.

3rd. Bending the branch down so that the breaking part is reached at the point of cutting. As the branch is pressed down the cut opens and should be kept open by the insertion of a small stone or piece of wood between the split part and the whole. Roots form more quickly when this is done.

4th. Pressing the branch well down into the soil to a depth

of from 4 to 6 inches, covering it with soil and pegging it down so that it may retain its proper position, firming the soil round the cut.

5th. Keeping the soil round the inlayer in a moist condition.

6th. Cutting off the branch above the layer after the formation of roots of sufficient strength to support the " layer " and thus allowing it to become independent of the parent tree.

7th. The removal of the layer after it has become well established on its own roots to its final position in the orchard.

The greatest number of layers produced in one season from one tree which the author has ever seen was 40, so it is evident that at this rate of propagation a very long time would elapse before a large supply could be available. Many trees have such a habit of growth as not to lend themselves to the production of layers, and some would not be worth propagating. As an aid to final uniformity in the standard of quality of oranges we produce, the layer system will be of service. But as a commercial proposition it is not likely that it will ever be extensively resorted to.

The production of citrus and especially of orange trees by grafted root cuttings has not been tried to any extent. The system is the same as that in vogue for the supply of apple trees on blight-proof stocks, and with care should be capable of providing us with orange trees equally as uniform as regards fruit produced as those last mentioned. The selection of roots demands especial care, and they should be sought for from amongst the healthiest trees available, either orange, lemon, or pompelmous as required. The selection of wood for grafting purposes of course requires equal care, and the type to be propagated should only be of the very choicest. Root cuttings of 6 inches in length are whip-grafted with the selected scions of 6 or 8 inches long and of equal thickness and treated much the same way as is described in the production of apple stocks.

The resulting fruit is as uniform as that to be found on any layered tree; propagation is far more rapid.

Much has been said about our good South African seedling oranges. When an outstanding fine type of this kind is desired to be propagated, the method is even more simple and sure. It consists of propagation by means of root cuttings alone. No outside influence in the shape of cuttings and scions of doubtful parentage can by any means be introduced, and the fruit eventually borne on trees raised from root cuttings will be an exact replica of that produced on the parent tree, provided the same soil conditions exist. Cuttings of orange or lemon roots may be taken

and cut into lengths of about 15 inches and up to about ½ inch in thickness. They may be laid in the ground in rows transversely, *i.e.*, across the run of the rows and not lengthways, at a depth of 3 inches or so. They must be kept damp, but not wet. A couple of shoots may be expected from each root. Longer roots may also be used and laid straight along rows, not across; these will send up shoots at irregular distances and will need thinning out and putting into shape generally.

Meanwhile citrus trees will continue to be raised from seeds as being the quickest, easiest, and most economical method. As stated previously, the rough lemon is the favourite stock in use in South Africa. Seeds of these are taken from fully ripe fruit some time about the end of July or August. They are washed out, those floating on the water discarded, and the remainder, being good, sound seeds, are planted in seed beds. They may be either sown broadcast or set out in rows. In either case the soil of the bed should be of a light sandy nature and easy of penetration by the roots of the young trees. When from 10 to 15 inches high they may be transplanted into nursery rows at 4 feet apart and 15 inches in the row. Plenty of room is essential for the formation of a good tree, both as to root and branch.

After a few months in the nursery the trees attain the size for budding. This is when they become from the thickness of a pencil to ½ inch in diameter. Budding is usually done in August or September if Spring budding is contemplated, and in February or March if dormant budding is wanted; if the latter, the buds remain dormant until the spring. It takes from six months upwards for the buds to grow to a sufficient size for the trees to be moved from nursery to orchard for planting in permanent positions, all depending on the climate.

Growing from Cuttings.—It is not customary to propagate fruit trees by means of cuttings. Whilst the system is widely employed in the multiplication of many kinds of plants and ornamental shrubs, very few fruit trees are raised in that way. The grape vine is, of course, an exception, and is extensively propagated by this means, but amongst fruit trees we find that only the quince, mulberry, pear and plum are regarded as being suitable for production in that manner. The last two fruits may be, and are, raised principally from one or two varieties. Cuttings of the Keiffer, Le Conte, and one or two other pears of Asiatic origin strike readily and will produce fairly good trees, though possibly not as long-lived as those raised from seed in the natural way. Myrobolan and Marianna plums are also raised from cuttings as well as from seed, and produce strong and thrifty trees.

The ordinary method of growing quinces and mulberries is by

the use of cuttings, and both these trees thrive to such an extent that the practice of growing them in this way is universal.

Cuttings may be made at any time of the year throughout the greater part of South Africa where the rains come during Summer. Cuttings made during August, just before the buds begin to swell, appear to be most successful. They may be made of any desired length, either 12–15 or 18 inches or more. The cuttings should be severed from the parent branch just below a bud, and should be made by means of a straight cut across the wood and not a slanting one. A pair of shears is better for the purpose than a knife. Whatever length the cuttings are made, it is customary to set them in the ground for fully two-thirds of their length. Thus a cutting a foot long would have 8 inches in the ground and 4 inches above, and so on.

Slips are sometimes planted, and when this is done the slip is laid in the ground in a slanting position, having the same proportion of its whole length in and above the ground level as in the case of the cutting. A "slip" is a small lateral branch or twig which may be pulled off the main branches of the tree, and is usually accompanied by a small section of bark which has been torn with it from its source of origin. Slips grow equally as well as and perhaps more readily than some cuttings.

CHAPTER V

BUDDING AND GRAFTING OF FRUIT TREES

"THE ancients have taught us three kinds of engraftments, one which, after the tree is cut and cloven, receives the scions that are inserted into it, another which admits the grafts between the bark and the wood, both which kinds are proper for the Spring season. The third, which the husbandman calls 'emplastration,' receives the buds themselves, with a little bark, into a part of itself from which the bark is pulled off. This kind is proper for Summer.

"When we come to explaining the method of performing these engraftments, we shall also teach you another method invented by us."

The above words were written by "Columella," a celebrated Roman authority on all matters connected with agriculture, horticulture and viticulture, in or about the year A.D. 55. They point unmistakably to the extreme antiquity of the practice of budding and grafting. It is impossible to state the origin of these operations of the fruit grower. Columella himself refers to the "ancients" as having taught them.

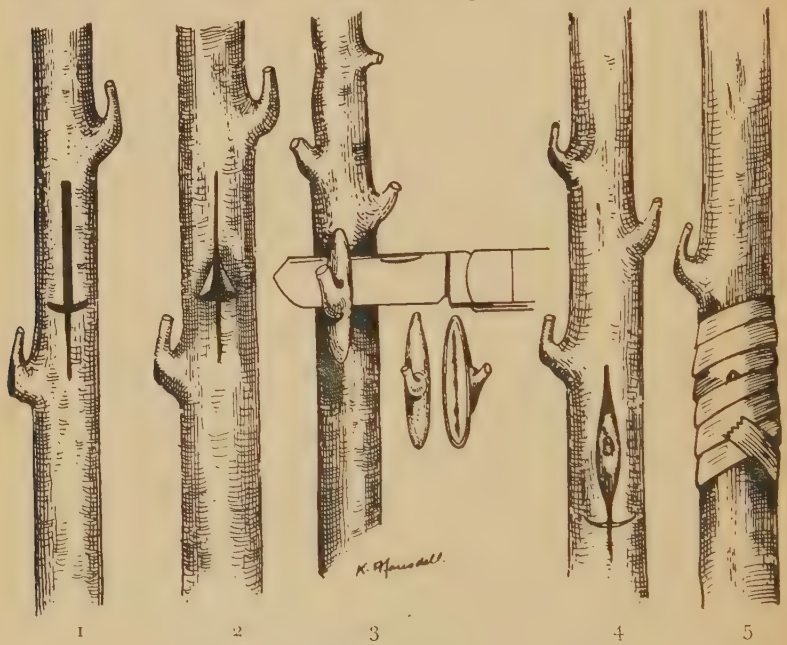
Present-day practice is confined very largely to a few methods which are well known to most fruit growers and nurserymen. The latter rely principally upon ordinary budding for the production and multiplication of trees in the nursery, whilst the former are more likely to resort to either budding or grafting for the purpose of altering one variety of fruit to another for which there is a greater demand.

Budding, the "emplastration" mentioned by Columella, is carried on in many different ways. The shield bud commonly in use has been and is likely to remain the favourite method practised by nurserymen. It is simple, rapid and satisfactory to use and may be learnt by a smart youth in a few hours. An experienced budder should be able to put in from 1000 buds per day upwards. Some manage to insert as many as 3000 buds per day, but to become expert requires plenty of practice, and great rapidity of work is not always as desirable as a slower and perhaps more sure progress.

The principal points to be borne in mind during the operation of budding are that the stocks are fit to bud, *i.e.*, that they are in a

growing condition and that the bark when the incision is made by the knife " slips " or separates from the wood freely.

The budwood should be also in good condition; the best buds are cut from branches growing towards the middle or lower portion of the tree rather than the top. The wood so situated is likely to be better matured than that found in the upper branches. The best buds to use are those which are developed first and are nearer the butt end of the branch than the tip. Buds from the tips of



1 2 3 4 5

DIAGRAMS OF BUDDING.

1. Bark slit for insertion of bud. 2. Bark raised ready to receive bud.
3. Cutting the bud. 4. Bud inserted.
5. Bud wrapped.

branches are rarely used. Budwood should be kept in proper condition. It should never be allowed to dry out. Some experienced budders prefer buds a *little* on the dry side. They say they are then in a more thirsty condition and will assimilate sap at a greater rate and grow more quickly than if they were in a greener state. It is, however, safer to use only buds which are not even beginning to dry out. Budwood should be taken to the field or nursery where it is to be used, wrapped in damp canvas and kept from sunlight and air. This is to prevent evaporation of moisture and possible sun scorching.

Budding knives should be kept clean and sharp as a razor, so that the buds may be cut from a budstick with a clean cut and not with any torn edges. The actual operation of budding consists in a downward slitting of the bark of the tree and inserting in the opening so made a bud from another tree of the desired variety. In order to facilitate the insertion of the bud a cross slit is made as shown, transversely across the first. This cut may be either across the top, middle or bottom of the first, as desired. Usually, when made at the top, the bud is pushed downwards into the slit, when at the bottom it is pushed upwards from below. Each bud is cut from the budstick as required and immediately placed in its position. Common practice is that most buds of deciduous fruits are put in downwards and frequently, not always, buds of citrus trees are pushed upwards from below. When done in this way there is less liability of moisture from rainfall getting in behind the top of the bud. Should this occur, decay thereof would follow.

BUDDING KNIFE.

When the bud is in position the stock is bound round, as shown, usually with raffia grass. Sometimes soft cotton twine is used and occasionally waxed cloth or tape, the object being to exclude the entrance of air and evaporation of moisture. The tying in of the buds must be done carefully, pressure must be neither too tight nor too loose. Raffia grass, being flat, induces an even pressure over the stock which is not obtained when twine is used. The tying of the buds is generally done by " boys " who follow the budder in his work.

When waxed cloth is used for wrapping the buds, it is generally made by taking some thin white calico, which should be torn across in strips of about half a yard each, and these dipped into a mixture composed of equal parts of beeswax and best paraffin candles melted together in an open tin or iron pan. The strips are saturated with the wax thus produced and that which is superfluous must be removed by drawing them through two pieces of thin board. They are then hung on a line to dry. When this is done the calico may be cut or torn into lengths suitable for wrapping the buds. If this is considered to be too much trouble to make, tape of the right width may be purchased and similarly treated.

After the operation of budding has been completed about ten days, the buds should be inspected and the ligatures loosened.

If this is not done the growth put on by the stocks may cause tightening of the ligature to such an extent that the buds may be destroyed. Any which have not taken will have a dark brown appearance, and these may be done over again. The distance above the ground at which the buds are inserted varies with the subjects dealt with. Stone fruits may be usually budded about 6 inches above the ground, oranges and apples 8 inches and sometimes over.

Budding of deciduous trees may take place either in the Spring or fall of the year. Nine-tenths of the work is done during the later summer months, February and March being the most suitable, the sap does not run too freely at that period, yet the bark slips readily enough for good work to be done. April is mostly too late, as by then the sap has nearly if not quite ceased to flow. Budding in March is called " dormant " budding, as the buds remain in a dormant condition until the Spring, when growth commences.

The wrappings are finally removed from the stocks some few weeks after, and the buds are then allowed to remain untouched until about August, when they should begin to swell. At this time the stocks are all cut off some 3 inches above the inserted bud. This provides a " stub " to which the young growth from the bud is tied when it gets to be about a foot long. Raffia is again used for this purpose. The support afforded by the stub left on the stock is necessary for the young tree in times of high winds, and without it many might be broken off or blown out.

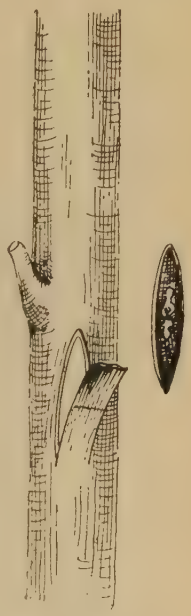
When the bud has grown out and become the size at which it may be removed from the nursery, the wood is hard and tough and the stub should be cut off. This is sometimes left until just before the trees are lifted. The cut should be made with either shears, knife or saw, depending on the size of the stock. The cut should always be a sloping one and not straight across the base of the stub. When cuts are made in that way it takes twice the time for the new growth to cover them as when a sloping cut is made. The exposed surface is then painted over in order to prevent evaporation. Any colour paint may be used.

Although Spring budding is not general here, it may be said that there are occasions when it may be advisable to make use of it. September budding of citrus trees is especially useful on occasion, when stocks have been left over from the previous fall, or have only just then attained size enough for budding.

In the Spring budding of apples, pears and all stone fruits, it is customary to cut the budwood it is intended to use about the middle of July, and either place it in cold storage at about 40° or bury it in some cool place in soil neither too wet nor too dry, but just moist. The actual work is identically the same as for dormant budding,

the only difference in the use of the two systems being that whilst in the case of dormant buds they remain inert for some months before starting to grow, in the other the buds are forced into almost immediate growth, and a tree is produced during the current season.

Chip budding is another simple method of propagating and the advantage with it lies in the fact that it may be successfully made use of when too late in the season to put in ordinary dormant buds. Chip buds may be put in during April and May, and in some instances success has been met with as late as June. The operation is equally as simple as ordinary budding and consists of removing the bud from the scion by cutting it just like an ordinary bud. The knife is then inserted at the back of a piece of bark of the stock and drawn downwards for about 1½ inches, then withdrawn, and the loosened bark is cut transversely across about half-way between top and bottom. This leaves a space bare of bark some ½ to ¾ of an inch and an open slit of equal length between the bark and wood of the stock. The bud, which should be as near the size of the exposed cut as possible, is inserted inside the cut portion, and exactly to cover the exposed space on the stock and tied in as described.



THE "CHIP" BUD.

In addition to the two methods mentioned, there are many others, mostly modifications of the shield bud. As an instance, the olive is most successfully budded by means of "twig budding," which is like shield budding, only that the bud is slightly larger and already has a twig which may be 2 or 4 inches long, growing from the centre. The success of this kind of bud depends largely on the removal of every particle of wood from the inside of the bud bark. The clean surface of the bud must come into contact with the cambium layer of the stock to the utmost extent. Tying in must be done as in ordinary shield budding.

Patch budding is another method, and consists of the removal of a square patch of bark from the stock and the insertion in its place of another piece of exactly the same size containing in its centre a bud of the variety it is desired to propagate. It is a little-used system apart from the mango, which tree appears to grow better than any other from the use of this method.

Annular budding consists of the removal of an inch or so of bark, more or less, from the stock to be budded by cutting completely

round and through it and the substitution in its place of another piece from the tree which it is desired to propagate having a bud in its centre. It is considered necessary to remove the first piece from a portion of the bark of the stock, having a bud, and the new piece must have the bud it carries placed in the same spot as the original one filled. This method is seldom used anywhere, except for the fig, and even in that case grafting, as a rule, gives better results.

OLD APPLE TREE FOUR MONTHS AFTER GRAFTING. MACCAUVLEI ORCHARDS.

[*Photo by E. Brandmuller.*

Grafting as a means of propagation of nursery trees is very little used now. The apple is grafted when it is grown on what are termed " blight proof " stocks, just as the vine is when it is worked on roots resistant to *Phylloxera*. Apart from these two fruits, practice has decided that the production of nursery trees is more satisfactorily done by means of budding, and so the grafting of young stocks for nursery purposes is gradually becoming a thing of the past.

Grafting over of older trees may be necessary owing to two or three different causes. For instance, many thousands of poor types of navel oranges have been worked over to either navels of a better class or to other varieties. This is usually done by budding. Apples and pears when worked over to other varieties are generally grafted. Varieties of plums planted in an unsuitable climate may be worked over by grafting to other and profitable kinds. Grafting is resorted to sometimes to dwarf the growth of a pear tree by using quince roots as the stock. Not all varieties, however, are subject to dwarfing by this means. In cases of old trees remaining unfruitful for some years, and allowed so to stay in hopes of future reform, it pays to

TONGUE GRAFTING OF BLIGHT-PROOF APPLES.

[From *The South African Fruit Grower.*

graft some other variety which is known to be a success on to them. Such trees after having been grafted will in three or four years' time become quite good property. It is certainly far wiser to make use of the matured root system of such trees in order to support a new head than to destroy, as it were at a blow, the growth of years.

No matter how old a tree is, it is possible to graft it over to some other variety by one of the many ways by which grafting may be done.

Root grafting as applied to the apple is done as follows, the time being mostly during July or approximately towards the end of the winter months. Suitable roots of some blight proof variety are selected. These may be cut from roots of old stock trees kept for the purpose, or perhaps occasionally from those of nursery trees of the previous year's growth which are in the process of being lifted,

and which, having an abundance of roots, can perhaps spare a few for the purpose. These roots are made into cuttings about 6 inches long and averaging about ½ to ⅝ inch in thickness, more or less. The scions to be grafted on them, also of some blight-proof variety, should be as nearly the same size as possible. The graft can, however, be made when the scion is much smaller than the stock (root cutting) by making sure that the inner bark of both root and scion come into contact when the two are placed together. The actual graft is effected by slitting the root with a sharp knife as shown, and treating the scion in a similar manner, joining them together, carefully adjusting the contact on one side of the graft of the inner bark of both root and scion. Should both scion and root cutting be of the same size, both sides of the graft may be made to come into proper contact throughout. When graft is completed, it is customary to bind it over with raffia grass.

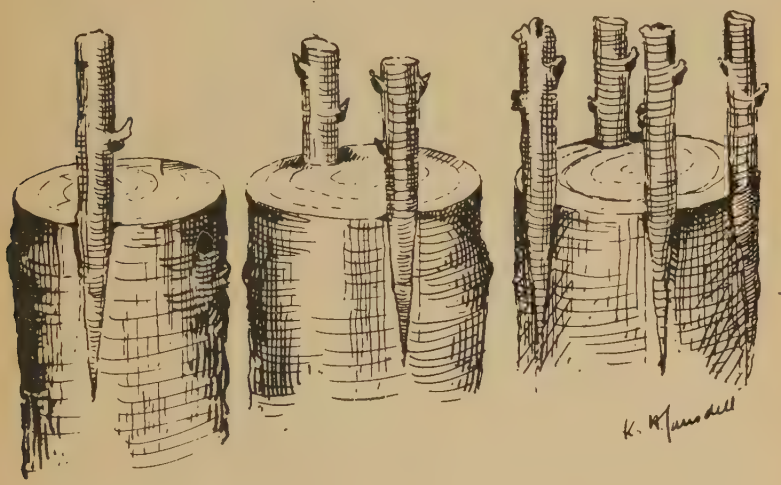
As they are finished it is usual, at intervals during the day, to collect the grafts and place them in boxes in alternate layers of damp sand, firming the sand round them, and placing the boxes in some cool place until it is time to plant the grafts out. This comes sometimes during August and when they are examined it will be found that union has taken place and they are ready for planting out in nursery rows. Those rows should be 4 feet apart and the plants set out 1 foot apart in the row. The grafts should be planted with care, the ground opened with a spade and held whilst the plant is placed in position, the spade is then removed and the soil trodden round the graft. By the following February or March growth has so far advanced as to admit of the young tree being again budded with the variety which is required. Thus the root and stock worked on it are both blight proof. Nurserymen use this class of double working in order to ensure the resulting tree being perfectly immune, as far as the roots are concerned, from the attacks of the woolly aphis.

Some growers graft the desired variety directly on the blight-proof root. When this is done there is always the possibility of the scion putting forth roots of its own which may grow rapidly, and so render the tree no longer blight-proof. Still there are some who prefer this single working and plant the trees high out of the ground in order to lessen the chances of scion roots being thrown out. A little careful watching should prevent them growing. The class of graft used in this way is termed a " whip graft."

What is called " saddle grafting " of young trees is possible and is sometimes resorted to, principally by the amateur. This kind of graft is usually made on stocks which have been in the ground for one season's growth, and consists in cutting the stock to the shape of a wedge, and placing on it the scion, which is split so as

to fit closely down on the wedge, which is as a rule about 1 inch to 1½ inches long. The same care is taken to arrange contact of the inner barks of stock and scion as in the whip graft.

The working over of older trees calls for the use of other kinds of grafts. The practice is not confined to grafting, as older trees can also be budded. As a rule it is not customary to bud on trees of more than three years of age directly into the old bark. When older trees, and especially citrus and peach trees, are to be worked over by budding, the entire head of the tree is removed during the winter, June being the best month. The stubs and the trunks of the trees are whitewashed, to protect them from sun-scald, and the new growths are ready for budding sometimes as soon as September or October, if not, they are allowed to remain until February or



CLEFT GRAFTING.

March before being budded. When this dormant budding is done, growth follows in the coming Spring. When trees are worked in this way, one has to select the growths which are to receive the buds with care, seeing that the branches are so arranged as to be placed symmetrically round the tree. Branches must be kept thinned, as often too many will grow, making the new top of the tree into a regular thicket.

The working over, however, of old trees is generally done by grafting, and the process resolves itself into the use of one or the other of two methods, the "cleft graft" and the "bark graft"; of the two the former is the most used. For cleft grafting, certain tools are needed. These consist of a keen knife with which to cut

the scions for inserting into the cleft, a heavy-bladed knife or some other keen-edged article with which to split the stock, a mallet to drive this into the stocks so as to split them and a chisel or other pointed article such as a wedge-shaped piece of wood with which to keep open the cleft after it has been made and during the time when the scions are being inserted, grafting wax with which to cover the graft when completed.

Two or more scions are placed in the stocks of large trees, depending on the size of the branches; for anything over 2 inches in diameter, three or four may be inserted. Less than 2 inches should require but two scions. The trees to be grafted must be cut down to about 1 foot or 18 inches, more or less, from the fork. The larger the tree the longer the branches may be left. Cut them off with a square cut, not a sloping one. Do not leave too many branches to be budded, six or eight should be the limit. Preferably six.

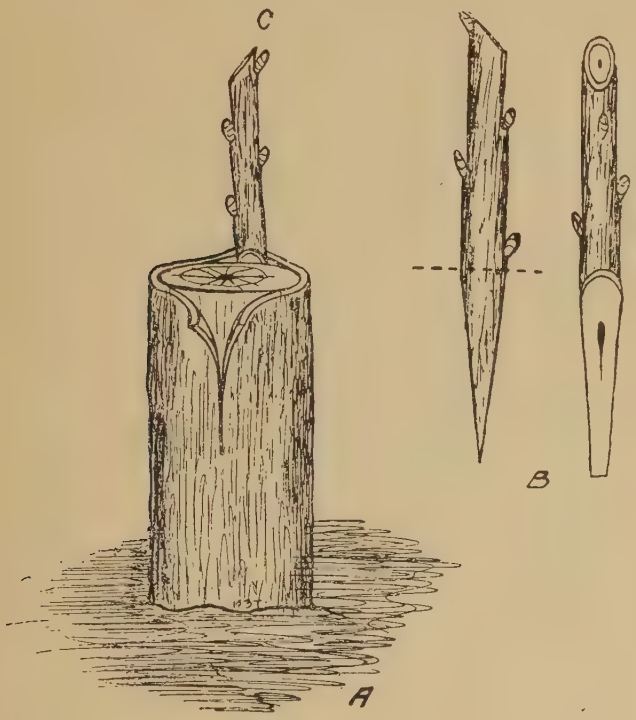
When all is ready, take the mallet and heavy knife and split the stock across; do not cut through the centre but to one side of the very heart of the wood when using two scions. When using more than two, make a split on either side of the centre. Do not split the stock too deeply, but sufficiently so as to allow the cleft when the scions are inserted to be able to hold them with firmness, but without undue pressure.

Cut the scions in wedge shape, from 1 inch to 2 inches in length, the outer, slightly thicker than the inner edge. This is to allow the pressure to be exerted more surely on the connecting points of the inner bark of both stock and scion than could be the case if both edges were the same thickness.

Open the cleft with the chisel and insert the scion, being careful about the matching of the inner barks of both for as great a distance as possible. In any case they must cross at some point, and often growth will proceed from the contact at a very small spot; it is better to have the fullest contact possible. If the pressure appears to be too great on the scions, take a small wedge of wood and drive it gently down in the cleft, so as to take some of the pressure off them. Then wax the whole over so as to leave no opening for air to enter. Wax the tips of the scions as well as the split of the branches, and leave nothing exposed. In a few days' time examine the work and see whether it is still sound. Sometimes bees will take away lots of the wax and expose the wood; when this happens the grafts die. Grafting wax is made in many ways. Nurserymen have each their own pet method. The best general wax is made as follows : 6 lb. resin, ½ lb. beeswax, 1 oz. raw linseed oil. Heat the lot in an iron pot which may be placed in an empty paraffin tin with a little fire in the bottom to keep the wax hot. The wax must be thoroughly

melted and stirred. Paint over the graft with a brush which should be kept for the purpose. The wax must always be applied hot.

Bark grafting is rather differently done; the stock or branch is not split, which to some appears to be an advantage. Instead the scions are slipped under it at certain points. They are cut differently from the wedges of the cleft graft, and so as to leave a



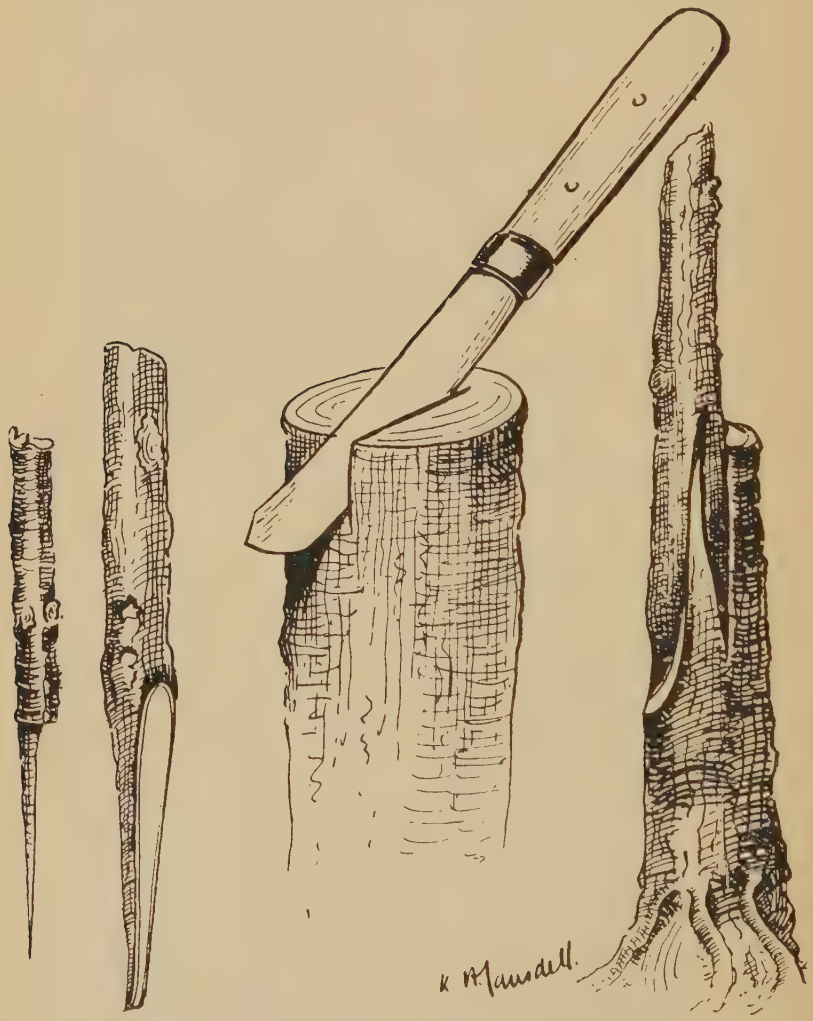
BARK GRAFTING.

(A) Stock cut back; bark opened for scion.
(B) Prepared scion (lower buds removed).
(C) Scion inserted between bark and wood.

[From *The South African Fruit Grower.*

bud at the outside of the scion with perhaps one or two others above it. The scions are about the same length as in the cleft graft, with two or three buds left on, not more. The scion is held firmly in the left hand with the bud facing away from the operator and the scion is whittled down to a point, leaving an exposed face about 1½ inches or so in length. The bark of the stock is then slit and the scion placed underneath by forcing it down gently.

When the scions are all inserted, they are bound round with a waxed cloth, or tape as used by electricians is a first-class thing to use. The tips of the scions must also be waxed over and the work



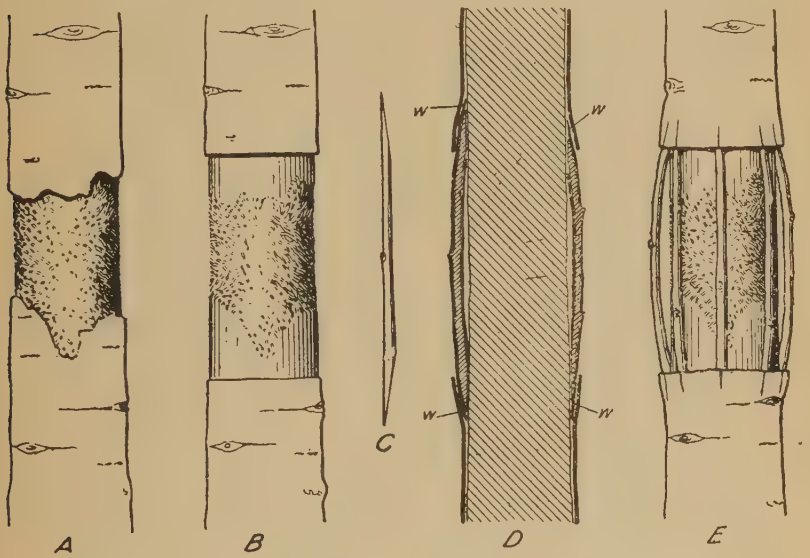
DIAGRAMS OF GRAFTING.

1. Scion for bark graft.
2. Scion cut for cleft graft.
3. Splitting the stock.
4. Tongue graft.

should be examined once or twice after completion at an interval of a few days.

Grafting is occasionally used as a means of repairing a fruit tree

which may have been injured in some way or other. Sometimes termites, rodents, either rats, mice or hares, will girdle a tree, eating away the bark, or collar rot may occur, leaving a surface exposed entirely bare of covering. Left alone, a tree in such circumstances must die. By the use of what is known as the "bridge graft" the life of the tree may be saved and it may still remain a source of profit. This style of grafting, though well known here, has not been used to any great extent in South Africa, as we have so few cases



BRIDGE GRAFTING.

(A) A damaged trunk.
(B) Same trimmed, ready for grafting.
(C) Scion pointed at each end.
(D) Scions inserted, note the arched shape and position for nails at W.
(E) Ready for finishing by waxing.

[H. B. Terry, from *The South African Fruit Grower*.

of real damage to trees of this nature, still there are instances of trees having been treated in this way which are strong and healthy today—bridge grafting is done as follows.

The bark at the top and bottom of the girdled portion is cut cleanly round so as to leave a smoothly cut, sound edge. Scions are taken from the upper part of the trees and cut to the desired length, which depends on the width of the girdling. They should be a couple of inches longer than the girdle. They are then whittled down just as in the case of the bark graft at each end and inserted

at intervals of an inch or so under the bark, which is slightly slit to receive the scions, and in order to make all safe, a tiny brad is driven through the scions to hold them in place, then the whole is waxed over to exclude the air. When possible this should be done about the end of July or at any time just before the Spring growth commences. As the grafts grow, they gradually spread all round the tree and the bare spot is completely hidden.

Grafting by approach is also an old practice in South Africa, though not widely in use. The term explains the method, which is similar to bridge grafting. It is useful in cases of root rot or when the roots of a tree are dying from any cause. Healthy young seedlings of the class of tree needed are planted near the one to be treated at 8 or 10 inches distance from the trunk, and when they have taken root and growth has started, they are beheaded and bent over so as to " approach " the sick tree; the actual operation of grafting is then performed in the same way as in the upper portion of the bridge graft and the seedling themselves eventually become the sole support of the tree.

New methods of budding and grafting are constantly being introduced, principally from America, but for general purposes those mentioned may be considered to cover all present needs. Perhaps it should be added that the practices of budding and grafting, simple as they are, can be successfully made use of only when plants of the same order are used.

The author was asked some time ago why, considering that the pear is successfully grafted in Europe on thorn trees, we should not here in South Africa make use of the myriads of thorn trees growing in the bushveld and convert them all into pear trees. The inquiry was perfectly *bona fide* and the reply was not fully appreciated.

CHAPTER VI

ORCHARD SITES, THEIR SELECTION, CLEARING AND PREPARATION

The site for an orchard should be selected with judgment and foresight, having particular reference to :—

1. Shelter from high winds. Freedom from damaging frosts and hailstorms.
2. Suitable soil and exposure, with good drainage.
3. Irrigation facilities if required.
4. Proximity to rail and markets, also, perhaps, packhouses.
5. Good roads.

When one plants an orchard, it is as well to reflect that the first cost must be considerable. A good orchard is planted not only for the immediate owner, but possibly for his children, and perhaps for theirs also. It is far wiser to select a good piece of land on which to spend money than a poor one. The work in either case would cost the same, excepting that a poor piece would require more fertilising and an excess of expenditure would thus occur under this head.

The difference in yield would be another matter of great importance. From a good orchard, planted on well-selected soil, well situated, up to 10 to 20 tons of fruit may be taken per acre per annum, whilst from poor land 100 lb. of fruit per tree or about 5 tons per acre would be about the limit. These figures are, of course, approximate, but fairly represent what might be expected.

Further, the planting of an orchard may be regarded as an investment. The life of the trees depend, not only on the care and attention they receive at the hands of the owner, but also on the land in which they grow. The better the land the more profitable the investment and the longer the paying capacities of the orchard.

Land either on a level or on a slight slope is in every way preferable to hill-sides with too steep a gradient. There is little risk of loss of soil from erosion by water washing in the former, and a great deal in the latter case. Cultivation is also a far more simple matter, as are all the other various operations connected with the upkeep of an orchard.

The question of drainage is an important one and must not be overlooked. Trees cannot live in water-logged soil. If holes are

dug during a moderately dry period of the year some 3 or 4 feet deep in the proposed orchard site, and are filled with water in the evening and retain it until the morning, such land may be rejected as having insufficient drainage.

Stony soils are also unworthy of consideration; whilst many gravelly soils may be suitable for certain fruits, rocky soils and sub-soils should be avoided. The sub-soils may be determined by examination.

To one entering the orchard business as a means of livelihood the suggestion is made that a wise investment would be to consult someone with wide experience, local and otherwise, before putting money into orchard lands. There are many reliable men who would only be too glad to help a beginner; of course, if funds permit, some adequate remuneration should be given.

The exposure or aspect of an orchard site is also worth considering. Throughout South Africa, with very few exceptions, an exposure to the north and east is regarded as favourable, just as in the Northern Hemisphere a southern aspect is preferable.

Protection from high winds can frequently be secured by planting in such areas as are naturally sheltered by the formation of the surrounding hills. Whilst this is possible, it is also important to guard against selecting a site so low-lying as to confine the cold night air in the immediate vicinity of the orchard.

Where natural protection against wind is unobtainable, resort must be had to other means, such as the planting of some tall quick-growing tree to shelter the smaller and lower growing fruit trees. The class of tree most frequently used in South Africa for this purpose is some kind of eucalypt. There are objections raised by some to the use of these on account of the far-reaching roots they all possess, which travel in amongst the fruit trees and rob them of their sustenance. Precautions may be taken against this by cutting a trench about 1 foot wide by 2 to 3 feet deep along the whole length of the row of trees at about 10 feet distant from them; this prevents the robbing which would otherwise go on. If these trenches are allowed to remain open, they are a permanent safeguard, but if filled up with soil the roots very soon again begin to find their way through and into the forbidden ground. If fires are made in the whole length of the trench after it has been kept open for a time roots do not grow as quickly.

In the Bush Veld and warmer areas, *Eucalyptus saligna* is a favourite, being an extremely rapid grower, sometimes averaging a foot per month. On the High Veld and in colder parts *E. viminalis* is very popular. It is also a quick grower, and will put up with very cold weather, standing frost better than most other gums. It is, however, subject to the attack of the "snout" beetle.

In warm climates *Grevillea robusta* or Silky Oak, as it is often called, is sometimes used; it does not grow as rapidly as the eucalypts, and the tree has a bad habit of constantly shedding leaves, a few at a time, but the roots are not such robbers as those of the gums. Casuarina, also called "Beefwood," is occasionally used for windbreaks; it grows quickly and also sheds its leaves (or needles) as the *Grevillea* does.

Pepper and gum trees planted alternately in a double row make quite a useful windbreak also, and there are many instances of the uses of various cypresses such as *C. macrocarpa* and *C. arizonica.* These are principally used in the colder parts of the Union. *C. arizonica* is the hardier of the two, and will thrive in a very dry climate where the *C. macrocarpa* should only be used for the purpose either within the coastal area or in some moist climate.

Pines are not favourites as a rule, yet they make a good windbreak, and are much used in the pineapple districts in the Eastern Province. *Pinus insignis* appears to be the most popular there, but *P. halapensis* is preferred in some areas.

Damaging Frosts.—Very little damage on the whole is caused by frost to the fruit-growers of South Africa. It is an unusual thing to hear of even an individual farmer who has lost a fruit crop from frost. Yet some loss does occur, and it is generally during the late period, say in September or October, when the fruit is of good size, that this happens to a deciduous crop.

So much care has been taken in the planting of citrus trees away from any possible danger from frost that it is only on very rare occasions that any damage is heard of in that direction. When frosts injure the orange, the worst period is during June and July. A few of the tender shoots may be nipped and some slight injury done to the fruit.

Amongst the deciduous trees, the almond is the most likely to suffer from frost on account of its habit of blooming so early in the season, and this causes the blossoms to be affected. Next to the almond comes the apricot, but any loss of crop in this case comes about as a rule from the late frosts spoken of. A temperature of 28° for a few hours is sufficient to destroy an apricot crop when the fruit has reached the size of a small walnut. At that time the pits are just beginning to harden, but are still soft. On examination after a frost they may appear brown or even black in colour, and if that is the case the fruit will soon all fall off the trees. Apart from these two, very few fruit trees of a deciduous nature are adversely affected by frost.

On the other hand, a good, long spell of frosty weather at the right time of the year is decidedly an advantage. It affords the trees a period of rest, which is often all too short in South Africa.

As a fact, no " freeze " of a serious nature such as ruined the orange groves of Florida in 1893 has ever occurred here, and it is to be hoped never will. Neither do we suffer in any of our citrus groves from frosts, such as may and do reduce the output of California oranges in those years when they are so unfortunate as to get them. As an instance, in 1912–13 the yield of oranges and lemons fell to 13,640,000 dollars from over 17,000,000 dollars the previous year, and again in 1921–22 the value was but 48,648,800 against 66½ millions of dollars the year before (Bulletin 57th Convention of Fruit Farmers, Cal., U.S.A., Dec. 10th and 11th, 1924).

Orange trees in the nursery will put up with 6° to 7° of frost without injury. Older orchard trees will stand a great deal more. The fruit is damaged at a temperature of less than 26°, much depending on the situation of the trees. The most exposed portions suffer first, usually the fruit on the lowest branches.

Hailstorms.—These occur in certain parts of the Transvaal, Natal, and the Orange Free State principally, although there are parts of the Cape Province also where they are not unknown.

A certain amount of damage is done when a hailstorm comes along. The risk is acknowledged and accepted. Naturally no one would willingly plant an orchard in an area which was recognised as being specially subject to hailstorms, and when such are well defined they should, of course, be avoided.

Proximity to Rail is worth studying; there is no doubt but that it is most convenient in many ways, and where a station is within a mile or two of the orchard the saving in time and cost of hauling both of supplies and crops amounts to a considerable item.

Land near a railway is usually to be had only at a higher price than other land, perhaps equally good or even better, but further afield, and the question arises as to whether it would not be wise to save money and pay a lower price for land equally good but minus the convenience to rail.

Orchard lands should be fenced as soon as possible after the site has been decided on and the clearing done. Windbreaks may be planted about the same time, or immediately after the fence is up is perhaps better. If it can be managed, a windbreak should be put in a year ahead of the fruit trees, although it seldom is. Where possible wooden fence posts may be used; some of our native hard woods are very suitable for the purpose. Sneezewood, when it can be obtained, is best of all, lasting almost as long as an iron standard. If wooden posts are not to be had, ordinary iron standards must be used with extra strong straining posts at each corner. These should be well anchored in the ground by burying a large stone to which a double wire is attached fastened to the top of the post, to a depth

of 2 or 3 feet and filling the hole up with stones and soil well tramped down.

In some cases it is necessary to fence with wire netting in addition to the ordinary four or five strands of No. 8 wire. The depredations of small buck are often of a very serious nature, and many hundreds of trees are lost from this cause annually. Hares, rabbits, and other rodents also account for a number of young trees by gnawing the bark from the stems. In order to prevent this, sometimes wire netting of 1½-inch mesh is cut into strips of the right size and fastened round the trees. Ordinary newspaper tied round the stems is also a preventive.

Although a very large area which is suitable for and may be devoted to orchard purposes is almost free from bush and trees, there is a far larger area which is covered with natural growths of considerable density.

The former areas lie largely on the High Veld. Those which require to be cleared range from the coast, where one may find dense and almost impenetrable evergreen bush, such as the Addo bush in the Cape Province, to the Karroo, which supports a growth peculiar to itself, to the western portion of the Cape Province where very large areas are covered with bush of the *Mesembryanthemum* order. In Natal there are what are known as the thorn bush districts, and in the Transvaal bush veld, an enormous number of different kinds of trees embracing many kinds of mimosa, wild fig, boekenhout and karree, whilst in the Low Country may be found gigantic specimens of many kinds of native timber.

The least formidable work is met with in the matter of clearing in the case of the Mesems and the Karroo bush, the smaller thorns coming next, then the coastal evergreens, which, though not high, have very large roots. The hardest of all is found in some of the very dense bush of the Transvaal, those areas with fairly large trees not proving any more difficult, whilst the Low Country giants are fortunately fewer and further apart and so do not prove as troublesome as they look.

Clearing is done in a good many different ways, but no matter what method is adopted the work must be thorough from start to finish. Not only must every tree and bush be removed from any land chosen for an orchard site, but every root also. It is impossible to lay out an orchard properly until the land has been entirely freed from any kind of growth and left perfectly bare. It is equally impossible to plough a piece of land in which roots of any size have been allowed to remain. It sometimes happens that land is set aside for planting which has been cropped by natives with mealies and other crops for years. Clearing has been done in the usual slipshod way which the Native adopts, tree stumps are left to burn

themselves out, and perhaps do not burn much below the surface of the ground, they soon get covered up and out of sight. The first thing the ploughman knows about them is when his plough runs into such a stump, which may be anything from 6 inches to 2 feet in diameter. Occasionally they may be rotten and the plough will get through them in safety. More frequently the stumps are hard and solid and when this sort is met with breakages of ploughs and harness are inevitable.

It has been stated that clearing land of trees must be done thoroughly. A further reason for this is that unless a good job is made of it there is a possibility of some roots remaining which may rot and cause the loss of more recently planted fruit trees by coming into contact with them. It is possible that the same fungoid trouble that causes the decay of the old roots may spread to the new ones with fatal results. This is not by any means an unknown occurrence in California, though it should be added it does not frequently happen. The author has only seen it in South Africa on two or three occasions.

When contracts for clearing are given out, no matter by what means the work is to be done, it is necessary to specify exactly what is to be done. The usual form of contract calls for the complete removal of all main roots to a depth of 18 inches and of all lateral ones of 1 inch or over in thickness; holes to remain open until inspected by owner and then filled in by the contractor. This is a good form of contract, and about the only one which when properly carried out is likely to give complete satisfaction. The price for the work will, of course, depend on the thickness of the bush, size of the trees, distance from rail and any arrangement which may be entered into with regard to the disposal of the wood. The contractor may be willing to quote a lower price provided he has the wood which he clears.

There are many contrivances which have been and are constantly being brought before the public from time to time to simplify the matter of clearing. New implements are patented each more capable of doing the work than the other, until the man who has the clearing to do is almost induced to believe that the work will do itself or only be a small job at the worst.

Many of these " stump pullers " are really good and capable of doing lots of work at moderate cost. There are " one man hand power stump pullers," also pullers for one, two or more animals, and most of these have their good points. Then there are heavy rollers for steam or tractor use, for rolling down low-growing bush and knifers for cutting the roots with ease. These " stump pullers " are so well and so widely advertised that it is not proposed to describe them here; besides it would be invidious to select any

special one to the exclusion of the rest and there is not room to describe all.

Some contractors will only use native labour, the "boy" with his axe, spade and mattock, they say, is hard to beat and can and will, in the long run, do better and quicker work than many of the "pullers." The actual cost of clearing, whether by hand or machine, comes out about the same for ordinary medium size bush, including trees up to 30 feet high. In the case of low bush cleared by rolling and root cutting, hand labour might cost a little more. It is necessary, of course, to add the cost of clearing to the price of the land.

Prices for clearing bush depend on the quality and thickness of the trees to be cleared and may run to from £1 to £10 per acre.

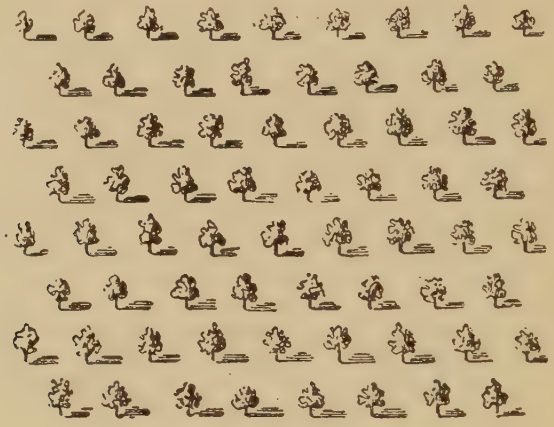
SQUARE PLANTING.

Dynamite is sometimes used as a means of getting out large stumps, but it is by no means a favourite method. Workers with dynamite at this kind of job complain that they become subject to headaches, and apart from that, it is scarcely as economical as hand labour.

Statements made in this connection may be met with a measure of doubt, but it must be remembered that much of our native labour can be depended upon to do this class of work in an effective manner and at no very exorbitant remuneration per head per diem.

The disposal of the brushwood or timber, as may happen, should afford some little return in the way of cash. In the case of small brush, which can be rolled and roots cut, there is nothing else to be done except burn it, and this may be done as soon as it is dry enough to burn easily. There may be some wood which will provide fencing poles, which are always useful on a farm, and, when the wood is suitable, will fetch good prices. Such trees as sneeze-

wood provide a post which is indestructible excepting by fire, and poles of these fetch very long prices.



HEXAGONAL PLANTING.

If the clearing is extensive there may be a market for firewood, provided transport is available and not too expensive. Last of all charcoal pits can always be made to take a very large percentage

QUINCUNX PLANTING.

of the larger trees, and there is always a fair if not a high price to be obtained for this product. The mines require a certain amount, and suction gas plants all over the country are always in need of

charcoal. The roots of most of the larger trees have to be burned as opportunity offers; they are often bound up in clay and soil and are difficult to handle in any other way.

After the clearing of bush has been completed, stones must be hauled away. As soon as the condition of the land permits, usually in South Africa some time after the first rains, it is thoroughly broken up by ploughing as deeply as possible. This may be done by oxen, or in the case of large undertakings it may be economical to purchase a Fowler's steam ploughing outfit. This consists of two engines stationed one on each side of the land to be ploughed. Both are fitted with a steel cable and winding apparatus. Attached to the cable is a reversible swing plough capable of ploughing 4 to 8 furrows at a time and this is pulled backwards and forwards through the land by each engine in turn and can plough comfortably from 8 to 15 acres per day, depending on the condition of the soil, at a depth of from 12 to 18 inches. The ordinary paraffin-driven tractor is quite a useful machine to use after the land is broken for cultivating, discing and ploughing, but is useless for breaking up most of our South African soils.

After having ploughed and harrowed the land, the question of levelling arises. This is of the utmost importance in those cases in which irrigation is contemplated; in fact, no satisfactory work of this nature can be carried out unless arrangements have been made to admit of every tree receiving its modicum of water. For orchards where no irrigation is necessary levelling of the soil should also be undertaken, partly for ease of cultivation, and the hauling of manures, fruit boxes and crops over the orchard, and also for the sake of appearance. A carefully levelled and laid out orchard takes the eye of a prospective buyer, whereas if it were full of little hills and dales the reverse would most likely be the case.

Levelling can be satisfactorily done by means of the use of land scoops and a leveller. There are a number of different ways of making the latter, home-made ones are the rule and not the exception. Finally, after the land has been broken up by the plough and reduced to a fair state of tilth by the harrow, it is desirable prior to setting out an orchard to take some kind of a crop off it in order to get the soil still further on the road to perfect tilth. No better crop for this purpose can be planted than maize, the roots of which are strong enough to open the ground and leave it in a better condition for the final ploughing before planting.

CHAPTER VII

LAYING OUT AND PLANTING

When orchard land has been treated as described in the last chapter and a crop of mealies taken off, it should at once be ploughed again to a depth of about 8 inches and either disced or harrowed until it has been reduced to a proper state of tilth—in fact to as perfect a state as possible. It is then ready for marking out for digging holes.

There are a number of ways of laying out an orchard; the old-fashioned one of planting trees in squares is as strong a favourite as ever. By its use each tree has a larger amount of soil from which the roots are able to draw sustenance. The trees themselves have more room in which to spread their branches above ground. The square method of planting is most satisfactory for cultivating, ploughing, spraying and irrigating when such has to be done, and although it is not perhaps as economical in the use of the land as the hexagonal, still, land in South Africa is sufficiently low-priced and plentiful to permit of that factor being disregarded.

Trees planted on the square system go, at 20 feet apart, 108 to the acre, at 22 feet they go 90, and at 24 feet 76. The actual marking out of the orchard land may be done in any one of several ways which appeals most to the owner. Here in South Africa ninety-nine out of every hundred orchards are marked out with a wire. The wire can be used either for the square or any other system of planting.

It should be strong, about No. 10 for size, and be of steel or fine twisted cable. What is known as picture hanging wire is sometimes used, it is strong and suitable, but rather expensive. Whichever is selected, it is necessary to thoroughly stretch it for a day or two before using. Whatever length is required is laid out on the ground, an iron ring is securely fastened to each end of the wire stretched to its utmost extent, the ends being pegged down and fastened by means of the rings to the ground. At evening after a day in the hot sun, it may be stretched again and also the following evening, after which the limit should have been reached. This is a necessary precaution, as should the wire stretch whilst in use the accuracy of the marking could not be relied on. After stretching, lumps of solder, the size and shape of a small bean, should be annealed to the wire at the required distance, whether 20 feet or more, or less.

If the land to be marked out is of considerable extent the wire might be, say, 100 yards long. To commence it is necessary to fix on a base line from which to start work; such a line should constitute part of one side of the orchard and that the longest. It should be at least 30 feet from the boundary fence in order to allow teams or tractors plenty of room to turn at the ends of the rows.

The square system of marking requires four men in order to make it run smoothly and well. In addition to the wire, each man is provided with a bundle of stakes about 20 inches in length; these stakes may be made of deal 1 inch square or cut from local timber. If the latter, they should be either whitewashed or painted white so that they may be easily visible. The wire is taken in hand by two men, one at either end, and laid along the base line, the other two drive stakes into the ground against each of the solder marks. All the stakes must be driven in the same side of the wire. When this is completed the wire may be moved along in a direct line and the operation repeated, until one side of the field is staked off, then a sight taken down the line will show at a glance whether the work is perfectly done or not. If any error has occurred it must be immediately rectified, as, if the base line is incorrect, it is not possible to lay out the orchard properly. When one can stand at the end of a row of pegs and, looking down it, find that they appear to be one continuous line, it may be assumed that the base line has been truly marked.

Having secured a base line, the next proceeding is to mark out another exactly parallel with it some 85 yards or so away. This is a comparatively easy matter, but in order that exactness may prevail in the measurements, it may be as well to explain how to find a "true corner" giving another line at exactly right angles to the first. From the third stake along the base line, *i.e.*, if the trees are to be planted at 20 feet apart, is a distance of 60 feet. Next, mark off 80 feet as nearly as you can guess at exactly right angles to the end of the base line and put in a stake there, then take the line and measure the distance between the stakes at the 60 and 80 feet marks. If the distance is 100 feet then you have a true corner, and the line can be shifted and marked out with stakes at one end of the base line in the same manner as that was done. The same operation takes place at the other end of the base line and then the wire is moved over and the line parallel with the base line staked out at the same intervals.

With these two parallel lines obtained, the rest is simplicity itself. The wire is taken and laid across from the 20 feet mark on one to the corresponding mark on the other line. Stakes are driven in at the solder marks, and then the wire is moved down the line step by step until the whole space between the base line and the one

parallel with it is filled with stakes, and the marking out in rectangular form or " squares " is completed. From this original block, marking may be extended indefinitely, the same system being used. It may occur that only small areas require to be marked out, but the same methods will give the same results. It is common practice to use a wire just the length of one side of an acre, *i.e.*, 70 yards minus 3 inches, in marking out small orchards; by the use of a wire of this length the land may be marked out into acre blocks.

Planting on the hexagonal or septuple system is more economical of space than any other which can be used. The trees stand equidistant from each other right through the orchard. They are, in fact, planted each at the apex of an equilateral triangle, and every tree is in the centre of six others. Economy of space is thus secured to the utmost. Against this system the plea may be advanced that one is able to plough and cultivate the land in three directions, instead of, as in square planting, in four. It is more difficult to irrigate or to draw furrows for so doing, and less convenient for the hauling out of the fruit crop.

Assuming that 20 feet is the distance at which the trees are to be planted, a base line is laid out as previously mentioned and stakes are set out at the right distance down the line. Again one must be particular to place them all on the same side of the line. Then take two pieces of wire with a 2-inch ring at each end and make them fit over two stakes set at precisely 20 feet apart, that is, each wire with its ring attached must cover exactly 20 feet. Two men then take one wire each and fix an end ring over the first and second stake in the row. Then they walk slightly away from the base line, approaching each other until the rings at the other ends of the wires come into contact. One ring is placed exactly over the other and a stake driven into the ground at the spot where they meet gives the first equilateral triangle. The operation is continued until further orders, and is as a rule beautifully simple and effective.

Another method calls for the use of a wooden frame, triangular shape, having the exact dimensions required, with holes provided at each corner. This frame is moved down the base line, placed over the stakes in place thereon, the apex of the triangle pointing inwards towards the land to be marked out and a stake driven in through the hole there. This method is almost equally as simple as the one previously mentioned, but it takes three men instead of two. Modifications are necessary in both of these systems when the land to be marked out is not level.

Still another and perhaps the best plan of laying out an orchard on the septuple system is possible by using the wire previously mentioned marked at half distances. The stakes at the sides of the land, those at right angles to the base line, require to be set at different distances from those in the base line. For instance, at

20 feet, equilateral triangles are formed by setting a stake exactly in the centre, between the first two stakes at a distance of 17 feet 4 inches, a 22 feet triangle by setting the stake at 19 feet and a 24 feet one by placing the stake 20 feet 9 inches away. Suppose trees are to be planted at 22 feet apart, the measuring wire is marked each 11 feet, and the base line staked every 22 feet, the lines at right angles to the base line are marked every 19 feet and the wire, which should be long enough to reach well across the land, is moved back to the first row of 19 feet stakes, and one end of it pulled out to the 11 feet mark. The wire is then staked along as before. This goes on alternately, marking from the 22 feet and 11 feet marks until the land is finished. All stakes should be set at the same side of the line, and each alternate stake should be pulled up.

Planted on this system, at 20 feet apart there are 126 trees, at 22 feet 103, and at 24 feet 86 trees to the acre.

The quincunx system is a favourite method of setting out an orchard when what are known as fifth trees are planted; generally speaking these are only set out for catch crops and do not form part and parcel of the permanent orchard. They stand each in the centre of four other trees and by their inclusion aid very materially, though not in an economic manner, to the number of trees which can be planted on one acre of land, thus trees planted in this way at 20 feet apart in the original square, with the centre tree added, give 199 trees, at 22 feet 173 and at 24 feet 137 trees to the acre. The simplest way of laying out on this system is to adopt the rectangular method first mentioned and set out the stakes at the necessary intervals. For instance, an orchard is marked out for rectangular planting in squares 25 feet apart, take four men and give each pair a sufficient length of wire. Let them go each to one of the corner stakes and hold the wires so that they cross in the centre of the square. A fifth man drives in another stake at the point of contact in the centre of the four trees. This is the quickest and easiest way of marking out on the quincunx system. Numbers of trees per acre according to the different systems of planting :—

	Square.	Septuple or Hexagonal.	Quincunx.
10 × 10	436	501	831
12 × 12	303	348	523
15 × 15	193	217	347
18 × 18	134	142	247
20 × 20	108	126	199
24 × 24	76	86	137
25 × 25	70	81	126
30 × 30	48	55	83
35 × 35	36	41	65

Distances for planting depend on the varieties of fruit being set out. Most orchardists prefer to be liberal in the matter of soil and there is no doubt but that it pays to give the trees all the room they require in order to gain perfect development both of root and branch systems. Most stone fruits are set at about 20 to 22 feet apart; apples and pears at 24 to 30 feet, all depending on the stock on which they are worked; almonds about 30 feet, walnuts 40 feet and over.

Digging holes for the young trees is one of those jobs which may be either inexpensive or costly, depending on the condition of the land. At the Cape, and more especially in the Western Province, the chances are that at the time of the year when holes are to be dug the ground will be soft and moist. Under such circumstances they cost very little to dig. In the Transvaal and other parts with a Summer rainfall and where rain is almost unknown in Winter, it becomes necessary to go to work in ground which may be quite hard, and the work then becomes more costly. Frequently a man cannot dig more than 20 holes a day, whereas in softer soil he could do 100. It is, of course, possible to go to work and dig holes at some time when other work is not pressing. By the time the holes are wanted, the soil may have fallen in round the sides; in any case they want reconstituting before being used for planting.

The ordinary sized hole for most fruit trees is 2 feet wide by 2 feet deep, and should be dug the right way. All the top soil should be placed on one side of the hole and the bottom soil on the other side, there should be no mistake about which is which, and so it is wise to have all the little heaps of top soil placed to the north and the bottom to the south, or any way which will be sure to be remembered. The soil at the bottom of the hole should be well loosened with a spade fully one spit deep.

A few years ago a movement was on foot with the object of increasing the sale of specially prepared " agricultural dynamite " for blasting holes for fruit trees. Let it be said at once that land which requires to be loosened by blasting is not fit for planting fruit trees of any kind. The finest fruit trees in the world stand in soil suitable for their growth, and no blasting can make unsuitable soil really fit for the improved growth of any tree. The author has seen trees which were planted in holes made by the use of dynamite. At the next visit, about six weeks after, they were almost out of sight. The action of the dynamite had loosened the sub-soil to such an extent that on the occasion of the first irrigation the trees had sunk into the ground and virtually disappeared.

There may be, however, a few instances where the use of dynamite is justifiable, as in the case of gardens in town, where land is very dear and has to be made the most of. Dynamite may then be

used to enable planting to take place at some specially desired spot by removing a rocky sub-soil or blasting away the rock itself.

Again in a long stretch of orchard, with the trees laid out in lines of the greatest symmetry, sometimes a reef may be found running across the land and so spoiling the appearance of the whole place. It is certainly well to blast away rocks in a case of this kind, and to plant out the whole of the land without any break, but it should be noted that in neither of these instances is dynamite used to do more than render possible the amelioration of a bad spot.

However, there is still another way in which dynamite may be used for the actual benefit of the trees, and that is in the case of hard pan, either by natural formation or caused by plough sole. When this is found, a charge of dynamite between every four trees will often so break up the soil that they begin at once to improve. The roots are able to obtain a little air and the top roots are no longer in danger of being rotted by an over-supply of water, which owing to the hard pan was unable to find its way down into the soil where it should go.

The use of the planting board is general in South Africa and with its aid it is possible to plant the trees in precisely the same spot as the marking out peg stood. The board is usually a deal plank about 6 feet long by 1 inch thick, having a notch cut into it at each end

and another in the centre as shown. The board is placed on the ground with the stake or peg where the tree is to stand exactly in the middle of the centre notch and close up to its apex, then two pegs are driven into the ground fitting closely into the notches at each end of the board which is then removed. The centre peg is pulled up and the hole dug. When the holes are finished the board is put back against the two end pegs and the tree planted in the spot occupied previously by the centre peg; the board is then removed and taken along to the next tree. The two end pegs come in for use again later.

Although as stated, the use of the planting board is pretty general throughout South Africa it is possible to dispense with it altogether and plant with only the marking wire. This is, however, only to be done with success when the ground is level. No laying out beyond two base lines is necessary. The first must be determined on as usual and the second placed exactly parallel as in laying out for rectangular planting. The wire is stretched across from peg to peg from the base line to its corresponding one parallel and pulled tight and either held in place or pegged down so that it may not

move. Then a spadeful of earth is removed and the holes dug round the mark made by the spadeful of earth removed. The wire is taken back, placed again in position and the trees are planted, all on the same side of the wire, against the solder marks it bears. The practice calls for patience as the wire is in the way when filling up the holes and tramping the ground.

Purchase and Selection of Trees.—It is presumed that the varieties to be planted have been decided on and the question then arises as to where the trees are to be purchased. It may be remarked here that wherever they come from, a strong point should be made in procuring the very best trees possible. Good healthy trees alone can form the foundation of a profitable orchard. In order to secure the best, the purchaser must make up his mind to pay a good price for a good article. £7 10*s.* per 100 should be about the right price for a good decidous tree, with possibly a slight increase for apples and also for the new varieties which are constantly appearing. Amongst the citrus family, good orange, lemon, grape fruit and naartje trees should be obtainable at £15 per 100, many are on offer for less, but 3*s.* for a good well-grown tree is a low price and some 25 to 50% lower than is asked in California. In any case avoid what may be called "cheap trees," a poor tree is dear at any price.

If it is possible, the purchaser of young trees should go to the nursery and select them himself, personally. If he is a novice at the game, he might get a friend with the necessary knowledge to go with him, and failing that he should place himself unreservedly in the hands of the nurseryman. There are many in whom one can place implicit confidence. It is unwise to place orders through selling agencies. The author heard quite recently from a well-known nurseryman who had sold to various agencies some 50,000 trees of a certain variety, but he had little doubt that 100,000 had been sold as being of that particular kind. Auction sales of fruit trees should also be avoided; such trees are often the "left overs" from the previous season's business, and it is only reasonable to suppose that the best have been picked out some time previously.

It is very necessary to place orders for fruit trees well in advance, in order to make sure of getting the varieties required; there is often a run on some particular sort, and it is well to get in early or disappointment may result. All deciduous trees are ready for delivery from the nursery in June or July. The selection should be made and order placed not later than the previous February. Planting time for most deciduous trees is from June 1st to August 31st, the bulk being put in during July. Early kinds of peaches of the Chinese type may be planted the end of May, as they are very

precocious and start blossoming and putting out leaves almost as soon as the almond.

As soon as the trees are delivered from the nursery, the wrappings should be removed and the trees taken out and placed in a shallow trench previously prepared for the purpose; it may be about 18 inches wide by the same deep. The trees should be spread out two or three deep in a sloping position, with the tops all pointing the same way the labels distinguishing the different varieties in evidence, and each variety separate. The roots will be the better for a watering, and should then be covered up with damp, well-pulverised soil until required for use. Should a long time elapse before this occurs, a further application of water will be beneficial.

Should the trees arrive after a long journey, as is quite possible in South Africa, in a wilted and shrivelled condition, they should be thrown into the dam or furrow, holus bolus, for a day and a night, after which it will be most likely seen that the bark has swollen out again and the trees have regained their healthy appearance. If this is not the case, a good deal of risk must be accepted in planting them.

The trees when wanted for planting should be delivered in the orchard in convenient numbers, not too many at a time, and the roots should be kept covered until the trees are taken for planting.

It takes three men to plant a tree properly. One man, the planter, to do the actual planting work and the two others to shovel the soil into the hole as required. The planter takes the tree and first examines the roots, removing any which may be bruised or damaged, with a clean cut, and cutting back those remaining to as uniform a length as possible. The more strong growing roots a young tree has, the better it is likely to thrive.

Before setting the planting board over the hole, the soil at the bottom is loosened with the spade, and sufficient of the top soil shovelled in to bring up the level of the soil in the hole to the requirements of the planter, which means that he will want the hole about half full before he attempts to plant. He then takes the young tree and places it in the central notch of the board, and after getting more earth thrown in, or perhaps a little taken out, as the case may be, he finds the level at which he wants the tree to stand, and spreads out the roots in their natural direction with his hands, no tool can do this work, and has a couple of shovelfuls more soil thrown in the hole. He then works the soil well in amongst the roots with his fingers, and has more thrown in until the hole is three parts full. Then he gets into the hole and tramps the soil down carefully, especially at the root ends in order to bring all into actual contact with the soil. Then a few more shovelfuls of earth from the bottom soil heap, and whilst the hole is still not full a couple of buckets of

water are thrown in. Later, when this has disappeared the holes are completely filled with soil and the planting is complete.

It is necessary to plant all kinds of trees at the right height above the level of the ground, the correct height being generally accepted as being the same as the tree formerly stood in the nursery. In order that this should be attained, it is necessary when planting to set the trees a couple of inches higher than they should apparently stand, in order to allow for the sinking of the tree which invariably follows the subsidence and settling of the ground in the hole.

As soon as the whole of the trees are planted, the tops must be cut back so as to leave the trees one uniform height throughout the orchard. This is not done merely for the sake of uniformity and future symmetrical appearance of the trees, but in order to give some compensation for the loss of the roots which have been left behind in the nursery or cut off at planting. It is not reasonable to expect a mutilated root system to support the entire head of the tree and so it is reduced proportionately.

In those parts of the country where no rain falls in the Winter, it is necessary to continue watering at intervals until the rain starts. About three weeks is as long as trees should be left without water, but much depends on the natural moisture conditions of the soil. Where winter rains prevail, as in the Western Province, it is necessary only to resort to watering at planting time, and later waterings, such as mentioned above, are almost unknown.

If the orchard is a large one, it is well to divide the whole into sections for reference later. When a number of varieties are present this is of much importance, especially to the beginner, as he is unable to distinguish one variety from another by the shape of the leaves or general appearance of the trees and has to depend on the nurseryman's labels for the different names. A map showing the different sections should be made, the rows of trees distinctly marked A, B, C, and so on, and each tree in the row numbered. It is an easy matter then to at once distinguish the variety. Later, when the trees attain size, the number may be painted on the trunk in either white or red paint, this will be found of great assistance. In any case, if the labels are allowed to remain on the trees as delivered from the nursery, all wires should be loosened and eventually removed, or, as the trees grow, it will be found that the wire will cut into the bark, to the detriment of the branches affected.

After every watering, even in the early stages, the trees should be dug round with a spade or a fork about every three weeks. The use of a rake or hoe is better than nothing. The object is to ensure the retention of as much moisture as possible for the young trees.

It is common practice to wrap young citrus trees, after they are planted, with long grass, in order to protect them from sun scald.

Where white ants are a pest, this is not a good practice as the dead grass attracts them and they may also attack the orange trees. When this is the case, whitewashing the trunk is the next best thing. Ordinary whitewash is quite suitable, but carbide residue sticks longer than anything else.

Before closing this chapter, it may be as well to say that the practice of cutting back after planting has been subject to a good deal of criticism. Possibly in some countries where growth is less rapid and general conditions are different, it may be suitable to allow the trees to remain unpruned, but long experience in South Africa with frequently-continued experiments has convinced the author of the absolute soundness of the practice of cutting back at planting time.

CHAPTER VIII

THE CARE OF ORCHARDS

After planting has been satisfactorily completed, the real care of the orchard commences. The trees are there, and will, if properly looked after, eventually repay their owner handsomely. It has been said that fruit trees return profits in proportion to the care lavished on them. It is certain that without continual care from the start no orchard should be expected to yield a profit.

The elements of profitable orcharding are to be found in a soil rich in all the constituents of plant growth and fruit production, maintained in a proper state of cultivation; in trees properly pruned and in a healthy condition; in a constant supply of water sufficient to afford any moisture the trees may require, and in drainage to prevent loss from waterlogged roots.

The cultivation of an orchard consists of the combined operations of the plough, harrow and cultivator, as occasion may demand. As a rule, an orchard should be ploughed at least once a year; it is often necessary to plough twice or even more frequently; much will depend on the weed growth encountered. In the warmer part of the country where weeds grow apace the author has seen an orchard ploughed four times in a season.

Ploughing takes place as a rule, no matter whether the rain comes in Summer or Winter, at the end of a rainy season. At that time the weed growth is at its maximum, and it should be turned under in as complete a manner as possible. There it decays and goes to form humus and possibly affords some slight amount of nitrogen to the soil, depending on the class of weeds.

Cross ploughing at a later date turns under the strips previously left untouched by the plough. Under ordinary circumstances, these two ploughings should suffice.

Constant turning of the land, when ploughing in one specified direction, has the effect of destroying the level of the surface. In any case this is objectionable and must be avoided. It is especially awkward when the land has to be irrigated. Thus, continual ploughing and turning the soil towards the trees tend to build up a long ridge of earth along the tree rows. This encroaches on the trunks of the trees and entirely buries the roots so that they cannot function properly; they are unable to obtain air. The tree itself

is liable to throw out roots from above the bud, thus rendering the tree, in the case of an apple, on resistant stock no longer blight-proof.

Again if the soil is always thrown away from the roots, the ridge appears in the middle of the rows and the trees suffer from exposure of the roots, which are then liable also to injury from different sources. In order to maintain a good level surface, therefore, it is necessary to plough alternately towards and away from the tree trunks and this will be found an entirely satisfactory practice.

When ploughing is over, it is time to think about harrowing and bringing down the soil to a fine condition of tilth. In the areas of winter rainfall, work of this kind commences about August, whilst in the Transvaal and other centres where the rains fall during the Summer, the ploughing and harrowing should be completed by March or thereabouts, depending on the season. After that, the use of the cultivator at intervals of three weeks to stir up the soil and to maintain it in a clean state and free from weeds is sufficient. This frequent cultivation takes place, however, with the object primarily of conserving the moisture in the soil. When soils are in good mellow condition with the necessary amount of moisture present, the development by the trees of a strong, vigorous root system is encouraged. When cultivation is neglected, moisture evaporates rapidly through the unbroken surface of the soil, and root growth, instead of being encouraged, is retarded.

Constant cultivation produces a layer of fine soil on the surface of the land and the stirring of this prevents the formation of a crust; it breaks up what is known as capillary action and keeps the evaporation of moisture at a minimum. Deep cultivation is not necessary; if the cultivator is kept about 4 inches down in the soil, that is sufficient. The finer the tilth of the land the shallower may the cultivation be and the nearer to the surface will the moisture be kept.

It is a mistake to think, in a country like South Africa, that an orchard can be successfully conducted without the use of proper cultivation methods. The author has seen instances of trees trying to live in the centre of a clean circle of land 6 or 8 feet across. The grass and weeds had been removed, and the ground " scoffled " and kept clean by hoeing round the trees. The centres of the rows were left full of weeds. Every weed acted as a pump, and extracted a certain amount of moisture from the soil, consequently they encroached on the clean area to such an extent that there was very little left for the poor trees. No fruit trees can be properly grown after this fashion.

Newcomers to South Africa sometimes wonder why all the orchards are run on the system of " clean cultivation," having

possibly never seen fruit trees growing previously in any other manner than in grass. Our South African sun is answerable for the difference. It is a very thirsty sun and removes an enormous quantity of water from the soil daily by evaporation.

By way of affording some definite idea as to what evaporation means here, the following table is quoted from the last report of the Government Meteorologist. It gives the average rainfall and evaporation at three widely-separated towns in the Union.

Comparative Table of Evaporation and Rainfall.

Month.	Johannesburg Union Observatory.		Molteno Reservoir, Cape Town.		Dunbrody, near Port Elizabeth.	
	Evaporation.	Rainfall.	Evaporation.	Rainfall.	Evaporation.	Rainfall.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
January .	6·51	5·57	10·30	0·93	9·10	1·16
February .	5·65	4·97	9·82	0·60	7·61	1·26
March .	5·07	3·76	9·10	1·16	6·55	1·73
April . .	5·13	1·27	5·75	2·77	5·01	1·47
May . .	5·10	0·69	3·16	4·72	3·83	1·19
June . .	4·35	0·09	2·48	5·63	3·59	0·89
July . .	4·91	0·33	3·50	5·23	3·72	0·64
August. .	6·60	0·58	3·62	4·20	5·03	0·82
September .	7·91	0·86	5·08	3·09	5·36	1·31
October .	8·41	2·74	6·80	2·08	6·37	1·33
November .	7·63	5·05	8·83	1·49	7·32	1·52
December .	7·40	4·82	10·04	1·35	8·70	1·56
Total .	74·67	30·73	78·57	33·25	72·19	14·88

It will be noticed that the evaporation amounts to more than double the rainfall in each instance, but the figures are given from free water surfaces. In the Transvaal, the figures for evaporation are on the whole considerably higher. Often the sun is more powerful, and dry winds occur which materially help to denude the soil of its moisture contents.

The provision of a "dust blanket" by the frequent use of the cultivator is the best means of counteracting the influence of both sun and wind and conserving what moisture the land may contain. This conservation is a matter of great importance always, but particularly so in seasons of drought, which are liable occasionally to occur. It is at such times that the orchardist who believes in keeping the cultivator going scores over his more indolent neighbour. He is able by its use to maintain his soil in a moist condition, whilst where this frequent stirring of the top soil is not practised, the

land becomes hot during the day and this heat is retained to the detriment of the roots. When rain does fall, the unworked soil is baked to too hard a surface to receive and absorb it, and the beneficial effects are lost owing to the water running off, whereas in the case of a well-cultivated orchard the soil is loose and ready to receive and hold most of the water which may be precipitated. Good drainage should account for any surplus.

Many opinions are held with regard to the advisability of growing some kind of crop between the young trees. It is possible that on occasion it may be imperative, from a pecuniary point of view, to exact the utmost from the land, and in such cases there is nothing to be said.

Such crops as beans, peas and pea-nuts are the least undesirable. They are leguminous and supply a little nitrogen to the soil. Of the root crops, beet, mangolds and carrots may be planted. Pumpkins, squash of all sorts, melons and cucumbers take away little from the ground in the way of plant food. In climates which are suitable Chili peppers, egg plant and tomatoes are permissible.

The crop most frequently grown, however, is the mealie (maize), and it is claimed that when planted in rows between the young trees this crop is beneficial as a windbreak. That may be the case, and so, provided that the nearest row of mealies is not closer to the trees than 4 feet, it is permissible to plant them. Any and every crop planted in the orchard should be properly fertilised and kept clean and free from weeds; this must be done either by single horse cultivators or by manual labour with hoes.

The crops which cannot be treated that way are those of the pumpkin family. The question is sometimes asked, " Can I plant trees in my lucerne lands? " The answer will depend on one or two factors. If the lucerne has been established for any length of time, its roots are deep in the ground. They draw heavily on the moisture contents and make very considerable demands on the plant food it contains. Under such circumstances, it would be unwise to plant any kind of tree amongst the lucerne.

Provided that there is an abundant water supply, such trees as apples and pears may be planted on land which is also to carry a lucerne crop. The lucerne should be planted between the tree rows and may be allowed to within not less than 4 feet from the trees. The strip should be narrowed down gradually year by year until it is completely done away with. Five years should see the last of it. Should there be a tendency to allow a strip to remain down the middle of the rows, it should be avoided, as prolonged cropping would prove detrimental to the growth of the trees in future. Cotton has been grown to some extent between rows of orange trees and fair crops have been taken off. This practice is,

however, dying out, as it has been found that certain insect pests are as much the enemy of the orange tree as of cotton.

Small fruits like strawberries and Cape gooseberries are sometimes grown between the rows. In the case of the former, the question of land either naturally moist or capable of being irrigated is a pertinent one. The Cape gooseberry is another matter and may be planted amongst almost any trees, preferably stone fruits, as it will grow in soil which is fairly dry. Like all crops grown in orchards, it should be thoroughly cultivated and that work kept up as long as it is possible to get a small cultivator in between the rows.

It must be borne in mind, after all, that the fruit trees are the important feature and whilst it may be necessary to intercrop for some one or another reason, no crop of any kind should be allowed between the trees after they have attained the age of four years. After that period the tree roots have spread themselves out in every direction and are in the way to meet between the rows.

Further, no matter what fertilisation is done, nor how clean the cultivation may have been, it may be definitely stated that the trees would have been better without any intercropping at all. Notwithstanding this, the impression is general that to allow so much ground to remain unproductive is wasteful. Little trees standing at a distance of 20 feet apart or more make a very small show in a large orchard and it is not to be wondered at that such a feeling exists.

Fertilisers.—The practice is general throughout South Africa to set out young trees without the addition of fertilisers of any kind to the soil in which they are planted. The idea held is that the young trees do not require any stimulant and that the ground in which they are planted is likely to contain all the elements necessary to successful plant growth; further, it is contended that the addition of fertilisers at planting time does not admit of a fair test of the land in which the trees are planted. It might prove quite satisfactory without any assistance and so one rarely hears of anyone mixing a little fertiliser with the soil at the bottom of the hole in which the tree is to stand.

Where the soil is moderately good there is much to be said in favour of the practice of adding no fertilisers, but when it is known that the soil is poor, a couple of handfuls of bone dust mixed with the soil at the bottom of the hole will make all the difference in the growth of the tree. During the period which elapses before the bearing period arrives, the usual custom is not to give the trees any fertiliser of a commercial nature. In other words, no "artificial manure." There is much to be said in favour of this practice and although there may be occasions where the application of such fertilisers might prove of benefit, on the whole most of our

soils are capable, not only of supporting plant life, but also of affording sufficient nutriment to the trees to make them conspicuous on account of the extremely vigorous growth they put on.

When, however, the trees commence to bear crops which become heavier year by year and the fruit begins to diminish in size, and the growth of the trees to be less vigorous, the attention of the grower is naturally drawn to these unpleasant facts, and it becomes apparent that fertilisers of some kind are needed to restore lost vigour.

Most fruit growers know that the addition of certain substances to the soil has the effect of increasing the growth and productiveness of the trees. That is the result of practical experience, though just exactly how these results are arrived at is not always perhaps quite clear.

The commonest substance to be applied is ordinary stable or kraal manure; as a rule it is ready to hand and for all fruit trees of a deciduous nature it is a most valuable fertiliser. For citrus trees stable manure is not desirable, the tendency to cause a coarsening of the skins of oranges has often been noticed. It contains, at any rate, four of the principal elements necessary to plant growth, nitrogen, potash, lime and phosphoric acid, though the latter is usually in quantities insufficient for South African needs.

Much will depend on the source of origin of these manures as to their actual chemical contents. Some of the old sheep kraals of the Karroo supply a manure very rich in potash, owing to the bush on which the animals have fed. Poultry excrements, on the other hand, are rich in nitrogen and require to be used with care and mixed with wood ashes when used round fruit trees.

Manure from oxen and cows is not as good as that from horses and mules, being more deficient in potash and phosphoric acid than the latter. In nearly all cases neither stable nor ox manure is sufficient for the proper fertilisation of heavily-bearing fruit trees and resort has to be made to commercial fertilisers.

Before touching briefly on these, it may be as well to speak about cover crops. Their use is now fairly general and is most certainly still gaining in favour.

Some kind of legume is generally in use. Velvet beans, sunn hemp, Kafir beans, cow beans, Mung beans, lupins, vetches, either *villosa* or *sativa*, are largely planted, though the latter are not commonly used. In addition other crops may be grown for turning under, such as rye, oats, barley and millet. These are not of a leguminous nature but go to form " humus," a most useful adjunct to all orchard lands. It may be said that without this factor our orchards would remain in an unproductive condition. Humus is, of course, also formed by the use of legumes and in addition a certain proportion of nitrogen is added to the soil.

Humus may be formed by the addition of almost any kind of cover crop, and in addition, from the stable manure just mentioned as well as from weeds, straw, trash of any kind including any waste cull fruits, dead leaves, etc., and the soil is thus benefited in a number of ways.

First. The ordinary red soils so common all over South Africa are barren of humus, raw, and harsh. Its addition makes them soft and mellow and easy to work, besides rendering them more fertile.

Secondly. The leguminous crops add nitrogen to the soil, which they gather from the air.

Thirdly. They render the soil capable of retaining moisture for a longer period.

Fourthly. A cover crop will prevent washing away of the soil which might occur from heavy rains.

Cover crops are generally planted at the beginning of the rainy season in the northern part of the Union and ploughed under after Christmas. In the Eastern Province and Natal, the same period is suitable, but in the Western Province of the Cape matters differ as to dates and cover crops are sown about April or May.

Planting seed for these crops should be on the liberal side rather than the reverse. Barley, oats and rye when used as cover crops should be put in at the rate of 90 lb. to the acre. Velvet beans 40 lb., Kafir beans and cow peas 60 lb., Mung beans 70 lb. and vetches 60 lb. It is not always possible to broadcast seed and when this happens it should be sown down the rows up to 3 feet from the trees. Ploughing under should be done when the different crops are in bloom. It happens sometimes that they are left to seed on the orchard, the crop is reaped and the stubble turned under. This practice is not desirable, as the soil does not benefit to the extent it should. If seed is required for sale or use the following year it is far better to set aside a piece of land for the purpose of raising that particular crop.

The use of commercial fertilisers becomes necessary when ordinary manuring proves insufficient. Many of the chemical elements which go to make up the plant food necessary for fruit trees are to be found in ordinary soils in quantities sufficient for their needs. This is especially the case in newly-broken lands; there are quite a number of these and they include magnesia, iron, sulphur, sodium, chlorine and silicon.

Deficiencies are found principally in phosphorus, potash, lime and nitrogen and these being necessary to plant growth are supplied by various " fertilisers " containing the different elements in various proportions.

Phosphatic manures are more generally needed than any others in South Africa. Soil analysis shows that a shortage of phosphates exists throughout the Union to a greater extent than is the case

with either of the other elements. This may be supplied by the addition of phosphorus in the shape of ground bones which may be had either as bone meal or ground bone of different fineness according as required.

Basic slag or Thomas phosphate powder.

Superphosphates.

Ground phosphatic rock and dissolved bones.

There are other sources of phosphorus besides these, but they are not as generally in use. Potash is supplied commercially either in the form of sulphate or muriate and South African experience goes to show that the former is more generally suitable for use here. Both are imported from Europe. Kainit, also a source of potash, is an imported article and was formerly used to some extent, but has latterly gone out of fashion.

Karroo ash, being the ash produced by burning old sheep kraal manure, found in countless tons in the Karroo, is a very useful potash manure, containing as it does from 8 to 12 per cent. of that commodity. Wood ashes are also valuable and should be saved for use on the land instead of being allowed to go to waste as is so frequently the case.

Lime is often lacking in many of our soils. It may be added either in the form of so-called " agricultural " lime, or ground lime-stone, which is a cheap and effective method of using it, or by burnt white lime. The grey limes produced from dolomite rocks are not as suitable, containing, as they do, a too large percentage of magnesia. Lime acts directly on both soil and plant. Any tendency to acidity of soils calls for lime as corrective. Its use helps decomposition of humus and organic manures and sets free nitrogen. It renders heavy soils lighter and is of great assistance in improving their mechanical condition generally. Plants grown in soil with no lime shortage appear to be more healthy and vigorous than when there is a deficiency.

Nitrogen is supplied to the trees both from the air and the soil. Some of our electric storms yield large supplies of nitrogen and after one of these it is not an uncommon thing to hear the remark, " You can almost see the trees grow."

Commercially, nitrogen is supplied in the form of nitrate of soda, sulphate of ammonia and guano, and these are the chief items in demand. In addition, nitrogen is obtained from bat manure, of which large quantities are available, but which should be very carefully analysed before purchase. Dried blood and slaughterhouse tankage, whale fisheries' scraps, cotton-seed meal and cyanamide are all drawn upon for nitrogen.

Amongst a somewhat large proportion of our fruit growers insufficient attention has been paid in the past to the very important

question of orchard fertilisation. There are no reliable statistics to which to refer. Very little work of an experimental nature has been undertaken either on the Government experimental orchards or any others and extremely little has been published in the way of reports on what has actually been done. There is thus very little to go on and it is suggested here that individual growers can and should do their own work of this nature.

Experimental plots of a couple of hundred trees fertilised in accordance with the grower's own ideas with checks of up to 50 trees of the same variety in the same soil without any manure of any kind cannot fail to provide information of the most useful character.

Soils vary in South Africa just as they do in other parts of the world, perhaps even to a greater extent, and these variations have all to be noted and taken into account. The Government has provided in the Agricultural Department means of procuring the analysis of any soil and although not everyone pins entire faith to the results of a chemical analysis, it is certainly wise when orchard soils are of one type and in sufficient bulk to have samples submitted for that purpose. The charge is nominal only.

Soil samples should be taken with care. The chemists like to have three samples of at least 10 lb. each, taken separately and put in separate bags. The first should be surface soil, the second from 12 to 18 inches below and the third from a depth of 2 feet. Each bag should be marked with the class to which it belongs so that no mistake may occur. The report will indicate deficiencies and probably contain advice for future fertilising procedure.

Fertilisers are best applied to the land just previous to the commencement of the rainy season, whether that may be in Summer or Winter. Practically all commercial fertilisers may be put down at that period with the one exception of nitrate of soda, which acts more quickly than any other, and it should be applied just at the time it is desired to see new growth start. The results are apparent within a very few days. For yellowing foliage and trees which have not a healthy appearance, nitrogenous manures often have a wonderful effect and prove of the utmost advantage, manifest improvement taking place within a month.

Broadcasting is the best method of applying any kind of fertiliser to the land, unless immediate results are required in work of an experimental nature, when a solution is made and the fertiliser applied in liquid form. All broadcasted manures, of no matter what nature, should be ploughed under as soon as possible and if this cannot be done they may be disced under, the idea being to admit of their incorporation with the soil as soon as may be. In the case of small trees, when fertilisers of any kind are used for any purpose it is sufficient to scatter them round the tree not nearer

than 18 inches to the stem and fully the same distance beyond the drip of the branches.

The quantity of stable or kraal manure which may be used per acre depends somewhat on the soil. Those of a light dryish nature do not seem capable of absorbing it properly and it may have the effect of rendering them still drier. But in soils of moderate texture with fair moisture conditions up to 10 tons per acre may safely be used.

Commercial fertilisers for ordinary orchard use may be applied in a general way up to the following quantities:—

Superphosphates	300 lb. per acre.
Ground bone and bone meal	300 ,, ,, ,,
Nitrate of soda	150 ,, ,, ,,
Sulphate of ammonia	200 ,, ,, ,,
Dried blood	300 ,, ,, ,,
Sulphate of potash	250 ,, ,, ,,
Muriate of potash	250 ,, ,, ,,
Agricultural lime up to	1500 ,, ,, ,,

Recently the use of the straw parts of leguminous plants, as adding to the soil both possible supplies of nitrogen and humus, has been practised in California and in some instances here also. Chopped lucerne is much in favour and it may be applied at the rate of 3 to 4 tons per acre. Pea straw, peanut haulms and bean-stalks are also acceptable.

Dr. Webber, of California, in his report on the South African citrus industry, says with regard to lucerne hay, "A ton of hay would contain 50 lb. of nitrogen, 81 lb. of phosphoric acid and 50 lb. of potash, and these elements purchased at the present prices of fertilisers in South Africa would cost 52*s.* 6*d.*, 1*s.* 6*d.* and 15*s.*, respectively. The nitrogen, phosphoric acid and potash in a ton of lucerne hay thus makes its value as a fertiliser for these elements alone about £3 9*s.* per ton, which is equal, or nearly so, to its ordinary sale value as hay. In using the lucerne hay as a fertiliser, however, there is a very large additional value in the great bulk of organic matter to which no exact money value can be assigned, but which is of great importance in maintaining soil fertility."

After all, the crucial question with regard to the use of fertilisers is, "Does it pay?" To this the author, from long practical experience with both citrus and deciduous orchards here and in California, unhesitatingly answers, "Yes." The experience of fruit growers in South Africa, in many instances where he has induced them to go in for fairly heavy fertilising, is the same throughout and the individual who now refuses to manure his orchard is the exception and not, as formerly, the rule.

CHAPTER IX

TOOLS AND IMPLEMENTS FOR ORCHARD WORK

It is necessary to maintain the orchard in the best possible state of tilth, and for this purpose tools of the right sort must be provided.

Much will depend on the class of land to be dealt with. Some ploughs may be quite suitable for a sandy or gravelly soil and next to useless in one of clay or turfy nature. The plough is mentioned first, because it is the base of all cultivation work and therefore a most important implement. Without it, thorough cultivation and deep tillage, such as a well-kept orchard calls for, is scarcely possible.

There are plenty of ploughs specially made for use in orchards. Many of these are of American manufacture and are suitable for the purpose for which they are intended. Most orchard ploughs are single furrow, and only a few of double furrow capacity are used in orchard work. Yet in large orchards, where the ploughing is an important item of expenditure, it is difficult to bind oneself to the use of a single furrow plough, and it is by no means an uncommon sight to see nothing but double furrow ploughs working in some of our largest plantations. Many of these are of English make and their owners say that their accounts for "spares" are not as heavy as some others. For ordinary orchard work, however, a single furrow plough is best. It is less clumsy to handle and more easily swung away from the trees in case of danger of barking them by too close proximity than with those cutting two furrows.

A plough cutting 12 inches which can be drawn by two good horses or mules should be about the thing for a 20-acre orchard or anything under. It should be one which will scour and remain bright and clean, one on which the soil will not stick, and though this is quite a simple matter in light sandy or ordinary loams, it is more difficult in soils of a clayey or turfy nature. A plough which scours well is a cheaper one to work than one which does not. It cuts its way through the soil unimpeded and turns over a clean-cut furrow, whereas a plough which clogs with soil from lack of scouring ability or from any other cause is harder on the animals and does not do as good work. The soil is left in poor shape as compared with that which is seen after a clean bright surfaced mould board.

Disc ploughs are not in general use in the orchard; it is, in fact, an unusual sight to come across one, yet they are useful in the

earlier stages of preparing the land and will often get through hard ground when a mould board plough would not touch it.

It is not customary in South Africa to plough as close up to the trees as one can possibly get. If this were the case a smaller plough cutting some 8 or 9 inches only would be required, so that danger of damage to roots by cutting them would be reduced to a minimum. It is the custom to plough to within about 3 feet of the tree trunks and then cross plough later, leaving a square piece of ground untouched. This is cut up and turned under by natives, who use spades or forks for the purpose. Selection of ploughs, and indeed all orchard implements, is best left to the actual user thereof, and he in his turn should (if he is a beginner) inform himself by inquiry amongst his neighbours as to the best and most suitable plough to purchase.

The use of a sub-soil plough is often extremely desirable. Constant ploughing with ordinary ploughs at about the same depth will leave what is known as a " plough sole," which becomes, in time, so hard and solid that it is impervious to water and consequently acts in the same way as any other kind of " hard pan " would, whether it were formed by pot clay or rock.

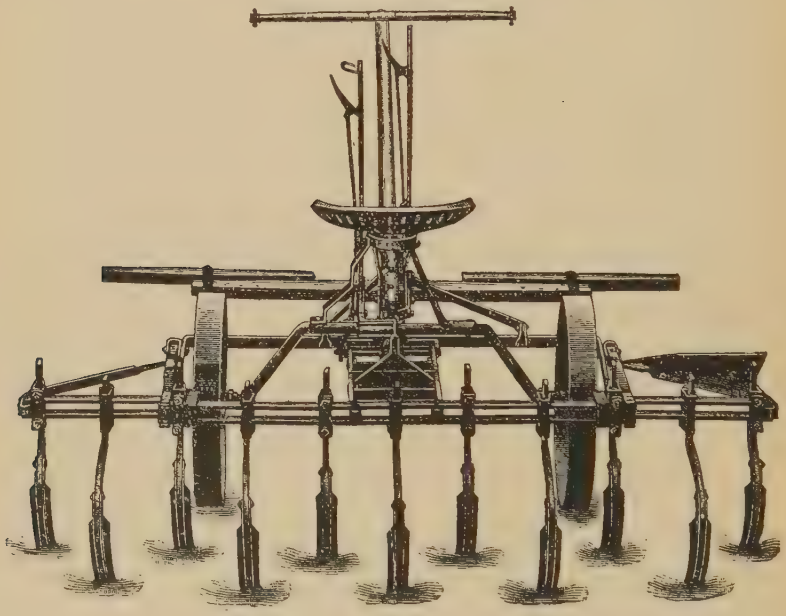
For breaking up this class of soil the sub-soil plough is an excellent implement. It is also useful for preparing land for planting purposes, when it is considered necessary to have the soil loosened for as great a depth as possible. It has been used instead of ordinary hand trenching in the preparation of vineyard lands, though there is nothing to equal hand work for that purpose. Sub-soiling of old orchard lands is often desirable. Very striking results follow the opening up of the old soil, drainage is improved and new and more vigorous growth takes place. It is true some few roots are cut, but this is a small matter and new ones are readily put out from the severed ends.

Harrows.—Next to the plough comes the harrow, and of these there is a large selection: the old-fashioned zigzag-toothed harrow with two or more leaves as may be needed; the spring-toothed harrow, which does very excellent work; the cutaway disc and the single and tandem discs. It may at once be said that the most perfect work is done by the tandem disc harrow. No other implement so thoroughly pulverises the soil. The front row of discs throws it in one direction and the back row reverses the process. This action not only acts as a perfect agent for reducing the soil particles to the desired fineness, but also removes all but the largest weeds.

The single and cutaway disc harrows are both useful implements, capable of doing good work, but of a less perfect nature than that done by the tandem disc. They are useful, when land is

rough, to reduce the clods and cut up any roots which may have been left after clearing the land. They do not leave the soil in a perfect condition by any means and should not be used on stony ground. The tractor power needed is, of course, about half that required for the double disc.

The spring-toothed harrow is a tool which reduces the ground to a finer tilth than either single or cutaway discs. It is also useful in clearing off all small weeds and may be used on stony ground where no disc should be used. This harrow, like the old zigzag,



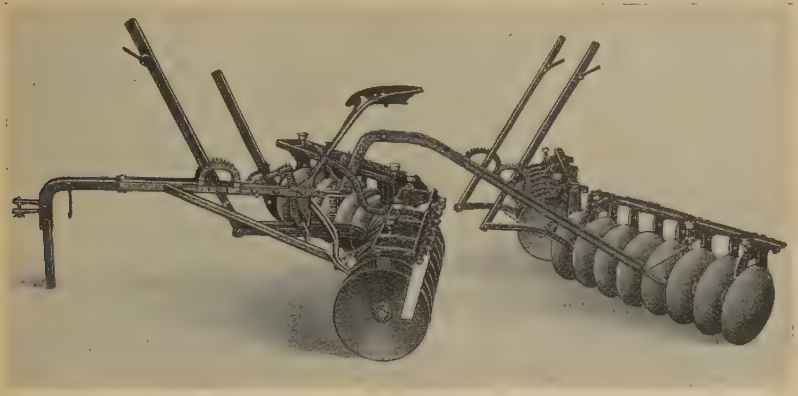
TWO-HORSE CULTIVATOR, ONE OF THE MOST USEFUL OF ORCHARD IMPLEMENTS.

is to be had with one, two or three leaves. Its use brings the soil down to a fine smooth surface. It may be used on occasion to take the place of a cultivator, as it stirs the soil perfectly for about 3 inches in depth.

The zigzag harrow, the old-fashioned one, is still much in evidence. After the plough the harrows should come and the zigzag may be used on any land, no matter how roughly it has been left, with the knowledge that it will do good work; often it is laden with large stones or logs to keep the teeth well in the ground. The zigzag has a very heavy draft, as, indeed, have most harrows.

The orchard cultivator is an indispensable tool. Not only is it

used to keep down weeds, which it does to perfection when used in season, *i.e.*, before they get to be over 3 inches in height, but during the portion of the year when no rain falls constant use is made of it to stir the surface of the soil and, by the formation of a dust mulch or blanket, to prevent as far as possible the evaporation of moisture. Cultivators are made to be used, either by one man, which means a small one for garden use, for one horse or mule or two or four horses or mules. They are fitted with teeth set apart as required at either wide or narrow distance. They are usually accompanied by a set of "ducks' feet" or "sweeps" which are principally used when it is required to destroy weeds. The one-horse article is made so that it will cultivate between rows up to



TANDEM DISC. RATHER HEAVY DRAFT, BUT RAPIDLY BECOMING WIDELY USED AMONGST FRUIT-GROWERS.

4 feet apart and is useful in nurseries. The 2- or 4-horse implement cuts up to 6 feet 6 inches. There are many good makes on the market, both English and American.

The roller fills the purpose of what is formerly called a "clod crusher" and is altogether a most useful implement. Used on rough soil after ploughing, it brings the surface to some degree of smoothness and leaves it ready for the tandem disc. There are many kinds of rollers on the market. The Cambridge roller, which is widely known and used, is now to be had of South African make. There are also American makes which leave the soil impressed with a neat pattern after use. This does no good, but pleases the eye.

Power.—All implements require power for traction purposes. In South Africa oxen are still used, although everyone knows quite well that this should not be done. They break the trees every

time they enter the orchard. In passing one, they will push their horns amongst the branches, causing lots of fruit to fall off, besides injuring more. They insist on eating the leaves and the branches of all trees as they pass, and unless they are muzzled this is a source of loss also. However, the ox is cheap to use, his keep costs next to nothing and his final destination is the butcher.

Horses can only be used in this country in those districts where horse sickness is not prevalent. Where it is possible to make use of the horse, there is no better animal for orchard work. He may not be as intelligent as the mule, but is certainly without the vices of that animal. On the other hand, he is dependable and becomes so accustomed to the work that he can almost do it himself.

Mules are able to live, especially after immunisation, in areas where no horses are to be found. For that reason they are much in use in orchards in those districts of the Transvaal and Natal where the horse cannot exist. Either horse or mule makes a satisfactory animal for use in the orchard.

Tractors, of which there are many makes available, are fairly dependable and get over the ground quickly. They do better work than can be obtained from any other source. The very pace at which they work when pulling a plough throws over the furrow slice exactly as it should be done. Tractors are invaluable for large orchards where lots of work has to be done in a short time; where thousands of acres have to be ploughed within a certain period, the use of tractors becomes almost a necessity. Unfortunately, they cost such a lot of money to run that they are beyond the reach of most orchardists. With paraffin, oil and petrol at existing South African prices the use of a tractor may be regarded as a somewhat expensive luxury. The small grower can manage quite well without it. Possibly at some later date when we can obtain paraffin, etc., at a more reasonable rate the tractor may be more generally used in South Africa.

It may be taken as pretty sound business to purchase all tools and implements at all times of the best possible makes and of the best quality. A cheap tool or implement is one of the worst investments one can make. There are always quantities of rubbishy things of this kind on offer, and as far as appearance goes, being nicely painted and got up to sell, generally they may look all right. It is wise, therefore, to get your goods stamped with the name of some reliable English or American firm of standing.

It pays to keep all implements and tools under cover. The cost of an implement shed is but little and the saving in the life of implements may amount to a good deal. A coat of paint annually on all parts originally painted is another way of lengthening the life of an implement.

CHAPTER X

IRRIGATION

It has been pointed out that fruit trees obtain their food partly through various elements which are present in the soil in a state of solution. That imposes on the grower the necessity of maintaining an adequate amount of moisture, by means of which these elements may become soluble and so available for plant food. Too much or too little might easily prove injurious or possibly fatal, if either an excess or a deficiency were unduly prolonged.

What is meant by an adequate supply is sufficient to ensure an annual growth of wood of a vigorous nature, together with regular crops of sound, good-sized fruit; without such supply, it is useless to expect any orchard to prove profitable.

Practically all citrus groves in South Africa are irrigated, the few which are carried on without any irrigation facilities are mostly situated near the coast and depend on the moisture of the atmosphere for the supply of their needs. On the other hand, whilst irrigation of deciduous trees is practised in certain parts of the country, the bulk of this class of tree depends entirely on rainfall for moisture supply.

Dormant during the winter season, deciduous trees do not naturally require anything like as much water as those which are evergreen. Irrigation of this class of tree is necessary when the climate is arid or rainfall inadequate to provide sufficient moisture to produce a full crop of fruit or when the fruit is undersized or falls off the tree or when the leaves turn yellow or wilt. Without sufficient moisture to supply the roots with their needful requirements one or the other of the above-mentioned results must follow.

No hard and fast rule can be laid down as to the exact quantity of rainfall required in order to produce and maintain the needful moisture conditions. Soil moisture under certain circumstances and in land situated within a humid belt must of necessity vary considerably from that to be found under arid conditions. Hill slopes as a rule will be found to retain less moisture than land in valleys or plains, and that which is there is at a lower level. Local surroundings may have considerable bearing on moisture conditions. There is a very great difference in the ability of various classes of soil to retain moisture; thus, soils of a light sandy nature require far more frequent applications of irrigation water than is the case

with clay soils, the former admit it freely but are unable to retain it, owing to the looseness of their composition and the ready percolation which occurs in such soils.

Clay soils or those of a heavy nature retain moisture to a far greater extent. Penetration is slower and more difficult and seepage is unable, owing to the formation, to take place as rapidly as in those of a lighter nature. Seepage and evaporation combined are answerable for the loss of moisture which occurs in all orchards. It will be seen, therefore, that the class of land employed has much to do with the quantity of water required.

It is agreed more or less as a general rule that most bearing citrus trees should receive a minimum of 40 inches of water per annum, part of which may be supplied by rainfall and the remainder from other sources. In the case of deciduous trees, the matter is a different one. They require no water during the winter when they are in a dormant condition; the moisture they need must be supplied during the growing period, excepting in that small area in the neighbourhood of the Cape Western Province where winter rains as a rule provide sufficient or more than sufficient moisture to supply the trees with all they require in that way.

A minimum rainfall of 20 inches is supposed to represent the limit below which it is not safe to plant commercial orchards of deciduous fruit without the aid of a water supply by means of irrigation. This figure, in the opinion of the author, is too little; a minimum of 24 would be safer.

Those parts of the country where irrigation of deciduous orchards and vineyards is practised comprise the south-west area from about Worcester northwards, portions of the Karroo, and the Eastern Province of the Cape with here and there other spots, and it is safe to say that water is needed to provide a supply of from 10 to 20 inches per annum in addition to rainfall. The drier and more arid the climate the greater the attempts which should be made to impound every raindrop which falls, and ploughing the land just previous to the commencement of the rains and leaving it unharrowed enable this object to be achieved. Thus the more thorough the tillage the more soil moisture is conserved and the less need is there to resort to irrigation. It will be noticed, therefore, that cultivation has a considerable bearing on the quantity of water required for irrigation purposes. In the Western Province of the Cape, the use of the cultivator during the dry summer months is continuous, not only as a means of directly conserving moisture by the formation of a dust mulch, but also in order that the ground may be kept free from weeds which draw on the soil for their moisture supply. The practice there is to assist the retention of the moisture which has been precipitated in the form of rain during the winter months.

In by far the larger area of the fruit-growing districts of South Africa rain falls during the summer. Weed growth is rampant, and what is sometimes called " clean cultivation " of the land during these months is entirely out of the question. The ground is so soft and spongy that animals cannot work on it. As soon, however, as it becomes possible, teams are put in and the ploughs rapidly turn the weeds under, there to rot and help to form humus. After that, by means of harrowing, discing and cultivating through the winter months, a very considerable percentage of the moisture is retained in the soil.

It is an axiom amongst fruit growers that after irrigation comes cultivation, and it does not matter whether the irrigation is the result of a good downpour of rain or whether it has been done artificially, but as soon as possible after either the land should be cultivated and kept stirred to prevent loss of moisture. It is quite instructive to anyone who has had no experience in handling orchard lands by these methods to dig a couple of feet into the soil of a well-conducted orchard and also to make a hole to the same depth in land which has not received any care. In the first instance abundant moisture will be present, whereas in the latter there is not likely to be any.

The time for irrigating citrus trees over almost the entire area in which they are grown commercially in our country starts with the blossoming of the trees and is continued throughout the setting and growing period of the fruit. That means that watering may commence in August and end about May, with instances among the later varieties of still further extension. It does not follow of necessity that irrigation must be regularly continued throughout the whole of that period, as what rains there may be will fall chiefly during the summer months, and at that time no other water need be used. There may be years when only three irrigations are needed whilst in years of drought seven or eight waterings or even more may be necessary. As summers in the Western Province are dry, irrigation of citrus trees takes place there during that period.

The time for irrigating deciduous trees and vines depends somewhat on the variety of fruit to be dealt with as well as the periods of rainfall. Amongst those which it is customary to irrigate apart from the vine are the apricot, peach, prune and fig with walnuts and almonds in addition. All of these are irrigated at some period of their growing season. Judicious use of water is especially required with apricots, peaches and prunes which are destined for drying purposes. Whereas it is possible and sometimes desirable to increase the size of stone fruits for canning purposes by a good watering a couple of weeks before picking time, it is unwise to water fruits for drying within a month of gathering them.

Fruit so irrigated will shrink abnormally, it will have an inferior appearance and flavour and is subject to caramelisation; in other words, the sugar contents are abnormal. In the case of the fig, there is danger of cracking and subsequent fermentation.

The source of supply of most of the water used in South Africa for irrigation purposes is either a perennial stream or dam in which water has been impounded as a result of rainfall or by the collection of various small sources of supply. Pumping from boreholes and wells, so common in parts of California, is almost unknown and unpractised. There are many large dams throughout the country, built either at the cost of the nation or by private enterprise. Amongst the very large works, the former, as is but natural, predominate and most of these have been built at a cost far beyond the means of private individuals, and a charge has to be made, usually of a moderate nature, to those who draw water therefrom.

Water from permanent streams is taken out by means of furrows so constructed that they may serve on occasion as many as half a dozen different farms. The entrance to the furrow from the stream is so arranged that the addition of a few sacks full of sand will raise the height of the water in the stream during the dry season so that it may be readily taken out into the furrow and flow by gravitation to its destination. During the rainy season this sand bank is removed, the entrance to the furrow is blocked up and thus all danger of flooding during that time of the year is done away with. Furrows such as these are often some miles in length. As a rule they are simply constructed, being merely dug out of the earth, though one may occasionally find one lined out with cement or grouted stone, a more expensive arrangement. Water supplied in this way by gravitation works out at a lower cost than by any other means and the cost of the furrows is also very little.

When the water is brought to the orchard, the matter of distribution has to be considered. The irrigation of citrus and deciduous trees and vines are two very different propositions. In the case of the latter it is an axiom that no water should come near the trunks of the trees owing to the susceptibility of many citrus stocks to diseases of the collar rot type. For that reason water is usually applied to the citrus orchards by what is known as the "furrow system." By its use a stream of water is led from tree to tree during the first year or two of their growth directly from a furrow which is made to flow in a single stream between the trees opening out into a circle to surround each, care being taken to prevent the approach of the water nearer than a foot or so to the tree trunk.

As the trees grow older and the spread of branches becomes wider the furrows are led down the sides of the rows as near to the trees as the branches will admit, *i.e.*, to the drip of the branches. Trees

when three years old would have one furrow running down each side of the rows, the same might be the case when they get to be four years old. When they get bigger the number of furrows is increased year by year until at last with the furrows at 3 feet apart there may be as many as six of them, practically all the available land between the trees is taken up with furrows.

In order that the water may sink in as deeply as possible, it is wise to plough the furrows deep and narrow rather than shallow and wide. Furrows should not be longer than 100 yards or the first trees will get more water than is good for them. After each watering the land is either cultivated, or disced in order to keep in as much moisture as possible and steady cultivation of one sort or another is maintained until a further irrigation is needed.

Irrigation of deciduous trees is carried on differently, as a rule, though there is no objection to the employment of the furrow system if it is considered desirable. There is less objection to the water being led close up to the trunks of the trees, as very little danger exists of causing trouble from disease of any kind. Flooding the entire area of the orchard is regarded as desirable for one or two reasons. In the first place, the land is more thoroughly soaked when flooded than by any other means. Secondly, flooding destroys innumerable insects, mostly when in the pupal stage, and this alone is a strong recommendation to the use of the system.

Flooding may be done on a large or small scale. The style commonly used is to select a long rectangular block of land for the purpose, which may be 100 yards in length and so possibly would contain fourteen or fifteen trees. Whichever system of flooding is used it is as well to have the orchard soil properly prepared so that the water may penetrate as rapidly and as deeply as possible. If water is applied to the land when it is in a hard, dry condition, a considerable quantity is needed before the surface is sufficiently softened to admit of any percolation to speak of, whereas when the land has been recently stirred, it is ready to absorb immediately whatever may be applied in the way of moisture.

Supposing it is decided to adopt the rectangular piece of land and flood a number of trees at the same time. A ridge must be thrown up in the centre, between two rows of trees, as long as may be required. This is done by ploughing a furrow, with a 12-inch plough, from end to end of the required distance, and a back furrow is turned against the first. This will make a ridge which may be sufficient to contain enough water for one irrigation when it is extended all round the area selected. If not considered sufficiently high, a further furrow must be added. The other side of the row of trees is treated in a similar way, and the end of the rectangle is finished off with a spade. Water is admitted from the end nearest

the main furrow and allowed to flow over the whole space until it is covered to the required depth. For a large orchard, it is necessary to run a fairly large furrow along the higher side of the land, in order to supply each rectangular oblong space with the quantity needed for flooding.

Whichever system of irrigation is resorted to, it is imperative that the land should be brought again into a level condition as soon as possible, so that cultivation may continue. The possibility of allowing any of the furrows or ridges to remain indefinitely cannot be admitted. In this country where the heat of the summer sun is

IRRIGATION BY MEANS OF CONCRETE UNDERGROUND PIPES WITH OUTLETS. THE BEST TYPE OF IRRIGATION SYSTEM.

Orchard of H. L. Hall & Sons, Tomango.

intense, any soil having the slightest tendency to " bake " would very soon become in an untractable condition.

Just how much water to give must be left to each individual grower. Probably he will have no means of measuring the quantity supplied, and so the matter, which really is of great importance, is left to chance. Water to the depth of an inch spread over an acre of land means a little more than 100 tons. The measurement of the flow of water before it enters the furrows or when used in flooding orchards affords a guide to the actual quantity used.

The use of concrete pipes for the conveyance of water underground for irrigation purposes has been resorted to in but a few instances in South Africa. The system is, however, one of the

very best. There is only one possible objection to its general use, and that is the initial outlay necessary for its installation. This is now much lower than it has been previously and it is possible to lay a 6-inch pipe at a cost of about 1*s*. per foot, including the necessary standpipes. The advantages to be gained by the use of this system are :—

1. The pipes being laid underground at a depth of some 15 inches below the surface do not interfere with ordinary cultivation of the soil.

2. Water measurement is simplified, as each standpipe has a number of holes for the exit of water, each of the same diameter, which may be and usually is 1 inch.

3. Water can be conveyed over slightly undulating land by means of these pipes where it would be difficult to get it by any other means. When this is done no sediment must be allowed in the water.

4. The system is economical, both in the quantity of water used and the amount of labour required to handle it.

The water is conveyed from a chamber into which no dirt or refuse can enter into the pipes, which are situated along the rows of trees with a standpipe at suitable intervals, depending upon the distance at which the trees are planted. Each standpipe has four or more outlets, any or all of which may be utilised at the same time for the distribution of water as each is controlled by a special arrangement.

Measuring the Water Supply

The following has been kindly supplied by Mr. C. D. H. Braine, A.M.I.C.E., and appeared in the *Farmer's Weekly*, May 20th, 1925.

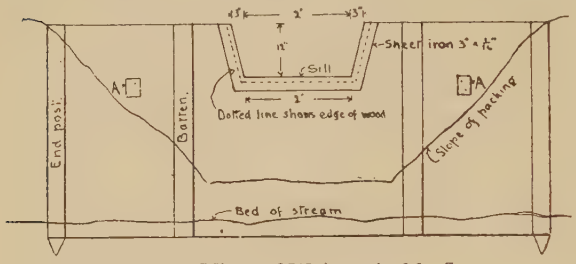
Table of Discharges for Measuring Weir

Depth of water passing over sill. Inches.	Discharge. Cubic feet per second.	Discharge. Gallons per minute.
1	0·080	30·03
2	0·226	84·97
3	0·416	156·07
4	0·640	240·26
5	0·895	335·88
6	1·177	441·48

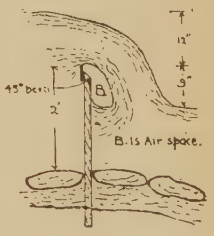
Column 1 is depth from still water to crest of weir. Still water being some 2 feet behind weir.

The measurements represent the quantity of water flowing over the sill of a

weir, 12 inches in width and the illustration shows the kind of gauging weir suitable for general use in furrows and small streams.



Upstream View of Weir, suitable flow of Water over Sill.



Section at centre of Gauge.

Measuring Water with a V-shaped Notch

This method is very suitable for small orchards. It is sometimes called a " weir notch." Its construction is simple and inexpensive. The notch must be a true right angle.

A carpenter's square set with the point at the spot which is to be the lowest point of the notch in a true vertical position with the sides sloping outwards and upwards, adjusted so that the figures on each arm are exactly level, will give just what is required. The position can be proved by placing a small piece of board across the arms of the square at the figures and testing it with a spirit level.

The " notch " for use may be made of wood with iron facings which must lie towards the upstream, or may be constructed of cement if desired. This style of weir is mostly used with a flow of water under 1 or $1\frac{1}{2}$ cubic seconds.

The flow is measured by a perpendicular rod marked with measurements depending on the table used. The figures given below are from a bulletin by the late Mr. Hurley, of the Irrigation Department. The rod must be placed with its zero mark exactly level with the apex of the notch. It should be marked so that the exact flow can be read at any time.

Height.	Discharge.	Height.	Discharge.	Height.	Discharge.	Height.	Discharge.
Ft.	Cu. secs.	Ft.	Cu. secs.	Ft.	Cu. secs.	Ft.	Cu. secs.
0·1	0·01	0·39	0·24	0·55	0·57	0·71	1·07
0·2	0·04	0·40	0·26	0·56	0·60	0·72	1·11
0·25	0·08	0·41	0·27	0·57	0·62	0·73	1·15
0·26	0·09	0·42	0·29	0·58	0·65	0·74	1·19
0·27	0·10	0·43	0·31	0·59	0·68	0·75	1·23
0·28	0·11	0·44	0·33	0·60	0·71	0·76	1·27
0·29	0·12	0·45	0·36	0·61	0·74	0·77	1·31
0·30	0·13	0·46	0·37	0·62	0·77	0·78	1·35
0·31	0·14	0·47	0·39	0·63	0·80	0·79	1·40
0·32	0·15	0·48	0·41	0·64	0·83	0·80	1·45
0·33	0·16	0·49	0·43	0·65	0·87	0·81	1·49
0·34	0·17	0·50	0·45	0·66	0·90	0·82	1·54
0·35	0·18	0·51	0·47	0·67	0·93	0·83	1·59
0·36	0·20	0·52	0·50	0·68	0·97	0·84	1·64
0·37	0·21	0·53	0·52	0·69	1·01	0·85	1·69
0·38	0·23	0·54	0·55	0·70	1·04		

Sub-irrigation may be, and sometimes is, a result of seepage of water from a higher level in the orchard to a lower one. Springs may occur which will keep a part of an orchard in a moist condition whilst the remaining portions are comparatively dry, and again seepage from irrigation furrows will afford another instance of sub-irrigation.

Neither of these may have been in the scheme of planting originally decided upon but have resulted as development was extended, and therefore can scarcely come under the heading of considered sub-irrigation. The possibility of this, *i.e.*, the studied application of water for the use of the trees from beneath instead of from above the surface of the ground has been for a long time regarded as one of the things much to be desired. The entire absence of loss of moisture from evaporation, and the fact that neither furrows nor ridges need be prepared and that less work in the way of cultivation would be necessary are factors of a nature which is bound to appeal to the ordinary orchardist from the point of view of economy alone. Yet, hitherto, no satisfactory system of sub-irrigation has been devised at all suitable for use on a commercial scale.

Underground pipe systems have been proposed and experimented with, indeed much work of this kind has been done, but the fact remains that the secret of successful sub-irrigation of orchards has yet to be revealed.

Brack Water.—Irrigation by the use of water which is usually termed " brack," *i.e.*, that which contains alkali, is to be guarded against. As a rule brackish areas are pretty well known throughout the country and left alone. Most of the streams from which

water is taken for irrigation are free from brack, but there are a few which most certainly are not. To attempt the irrigation of citrus trees, most stone fruits and apples with water from these streams is simply asking for trouble. The vine, fig, pear, olive, avocado and almond and to a certain extent plum and apricot roots may be planted in such areas as are watered from brack streams, but each one of them will appreciate pure water, and thrive to a far greater extent if that only is used.

There are many details connected with irrigation practice which may not at once be grasped by the grower of fruits under irrigation, especially if he is a new hand. For instance, the use of water should be undertaken at night where it is possible, and especially when it is scarce. Conditions are far cooler to work in than during a hot day, and so it is often the case that more actual work is accomplished. The principal reason for night work, however, is that loss of water from evaporation is reduced to a minimum. If night work for some reason or other is out of the question, watering should be continued as late into the evening as possible. The old-fashioned custom of watering flower gardens in the evening has much to say for it. There are a number of cool hours ahead during which the plants are not subjected to the hot rays of the sun and, recuperation being continued throughout the night, the result is apparent the following morning in the fresh, vigorous appearance of the plants. In the case of fruit trees, results may not be so immediately apparent, but they do appear. Anyone who has practised night irrigation will testify at once to this.

It is not wise to irrigate any kind of fruit tree too late in the season. The effect is a natural tendency to prolonged growth which may continue right into the colder season, when frosts are liable to occur and injure the branches which, in an immature condition, are far more likely to suffer than if the wood had been well matured.

Over-irrigation must also be guarded against. During the first two or three years of irrigation work more water can be absorbed by the land than is afterwards the case. Continued watering year after year has a tendency to raise the level of the water table in the soil and as a consequence less water is needed.

Another result of over-irrigation and also of late irrigation when practised in the case of vines and stone fruits is the liability to impair both the flavour and drying qualities. Watery peaches, plums and apricots are not wanted, but rather those with a full rich flavour. In the case of apricots, the effect of too late watering is most noticeable, especially if the fruit is to be dried. It is of little use filling up an apricot with water at the expense of sugar when it is to be got rid of again in a week or two by evaporation.

Over-irrigation is sometimes blamed for the rise of brack in the

soil. This, of course, necessitates primarily the presence of brack in the soil itself and has nothing to do with the application of brack water. As the water table gradually rises the brack arrives with it and affects the tree roots. Sound drainage systems will rid the land of trouble from this source.

Every irrigation scheme should be accompanied by a drainage system equal to any demands likely to be made on it. Frequently good natural drainage is present and should always be sought for in orchards which are to be irrigated as well as others which may not be. Without drainage, the evils of over-irrigation are increased to an alarming extent. Tree roots standing in water cannot function properly, the root hairs rot first, the roots cannot obtain food supplies and as a consequence disease follows. No proper aëration of the soil can take place in land which is at all water-logged, and without the penetration of air into the soil, natural root action cannot go on, thus many low-lying lands may be at once ruled out as not being suitable for fruit trees.

Brack soils may be rendered fertile by drainage of an efficient nature. In order to accomplish this, sufficient fresh water must be present to percolate thoroughly and freely into the land to be treated and the lowest area thereof must be selected from which the run off may take place. Drainage of a very perfect nature is required when land very nearly level is to be flooded with the object of ridding it of alkali.

Open drains are of frequent occurrence in parts of the Western Province of the Cape. These, as a rule, are not more than from 2 to 3 feet deep and so are hardly deep enough or equal to carrying away drainage water which would be present at a depth of perhaps 5 feet or more. Further, the open drain is a nuisance in all matters of cultivation of the land and their eventual disappearance is only a matter of time.

What is known as a French drain is very useful in cases where drains are required at a greater depth; it is really a sub-soil drain, and when used should always be put down after trees have been planted. If previously done there is a possibility of having to plant a tree just over the drain, or even a row of trees might come alongside a drain, which would, of course, be fatal. The roots would soon fill up the drains and much labour would be involved in putting things right. One of these drains may be anything up to 6 or 8 feet in depth. They are made to receive at least 1 foot of loose stones at the bottom, and these should be put in with some care so as to avoid choking as far as possible. On top of these stones a layer of brush, grass or rubbish may be placed and trodden down prior to filling the drain with earth.

Land is more frequently drained in South Africa now by the use

of drain-pipes than formerly, when they were hard to get and, when procurable, very expensive. Ordinary baked clay pipes, unglazed, in 12-inch lengths of from 4 to 6 or 8 inches in diameter, are procurable at reasonable figures. Irrigated land may need perhaps a regular system to remove surplus water. Pipe lines may be wanted down alternate rows of trees or, less frequently, leading down to a larger one, which should be able to carry off all water. The " lie of the land " should be studied before making any attempt at an expensive drainage of this nature.

With water removed from the first few feet, it is possible for tree roots to penetrate for their food. When the water table is within 2 or 3 feet of the surface, the roots cannot penetrate. The trees become shallow-rooted and liable to succumb to drought, whereas a deep-rooted tree would survive without any difficulty. Well-drained land is warmer in Spring and growth starts earlier than on land which is not so dealt with. Cultivation may be started and continued on such, whereas on undrained land it may not be possible to venture for fear of being bogged.

Whether orchards are irrigated or not, it is safe to say that many can be improved by drainage. Well-drained soils get " warm " earlier in the Spring than undrained soils. Growth starts sooner and continues longer; in short, is more vigorous.

There are but few kinds of soil which require no drainage, very light sandy ones with a gravelly sub-soil and others having a natural slope on a hill side being the principal exceptions.

When any doubt exists as to the requirements of the soil in the matter of irrigation water, it is a simple matter to put down a hole either with an earth augur or by digging to find out just what the existing conditions are.

CHAPTER XI

PRUNING AND THINNING OF FRUIT

THE relation between the above subjects is an intimate one, because the judicious use of the pruning shears will reduce the labour entailed in thinning very considerably.

Both have come to be regarded by the progressive fruit-growers of the Union as indispensable to the conduct of a good orchard, and although there may still remain many who grow fruit in South Africa who regard pruning as a heresy and the thinning of fruit as an indication of senile decay, the time is approaching when the old style of so-called fruit growing will have departed for good, and all the numerous functions necessary to the maintenance of an orchard in a proper manner will be taken in hand as a matter of ordinary routine and dealt with in their proper season.

More differences of opinion exist amongst orchardists on the matter of pruning than on any other operation connected with their calling; some advocate a system of "long pruning," others prefer "short," others a small tree so that fruit may be gathered without the trouble of climbing a ladder, while there is a strong party in favour of a large tree, they say the bigger the tree the more fruit it can carry and they do not mind climbing to get it, and so on.

It is not proposed to do more here than to mention the systems which have proved most suitable for South African conditions. Incidentally, they have been advocated by the author of these pages for many years past.

The necessity for pruning deciduous fruit trees arises because it has been proved beneficial to—

1. The health and longevity of the tree.
2. The systematic production of bearing wood.
3. The regular bearing of the trees.
4. The production of a tree of the shape desired so that it may be most profitable to the owner.
5. The admission of sunshine and light to the interior of the tree.
6. The improvement of the size and colour of the fruit, thus ensuring its increased value.

Pruning is done both in summer and winter, the latter pruning being the orchardist's " big job " of the year. It is then when the trees are bare of leaves that he is able to see exactly what branches to remove and cut back, and to detect the presence of any scale or other injurious insect or any diseases of a fungoid nature which may have remained unobserved during those months when the trees were covered with leaves.

Summer pruning is done for reasons slightly different from those mentioned. In the case of young trees—say up to three years old —it is often well to pinch back the rampant growths in order to produce stronger wood. In the case of non-bearing trees it is resorted to with the object of strengthening the existing and providing more fruiting spurs. In the case of rampant growths of the peach, plum, apricot and apple, such as may be found in older trees in Natal and the Transvaal and other sections where summer rainfalls prevail, the trees are benefited by the entire removal of the numerous growths which arise in the centre of the head; these are cut off close to the spot whence they spring—such work may perhaps be regarded as thinning rather than pruning.

Fruit trees which need an annual winter pruning are the apricot, peach, nectarine, plum, pear and apple, and these are those which are most widely grown commercially throughout South Africa. Fruit trees which do not require annual winter pruning are the cherry, prune, fig, quince, mango, avocado, guava, persimmon, olive, litchi, loquat, almond, walnut, pecan and chestnut.

The reasons in support of pruning may be stated as follows :—

1. *Health and Longevity of the Tree.*—More trees of a deciduous nature are lost annually in the Union from the effects of sun-scald than from any other cause. A low-headed tree subjected to an annual pruning puts on sufficient leaves to protect the trunk from the hot rays of the afternoon sun and thus lengthens its life. It affords an opportunity of removing any broken or decayed limbs which, if allowed to remain, might possibly tend to the distribution of disease amongst the remaining branches. Pruning adds to the vigour of the tree by increasing root-activity and leaf-production.

2. *The Systematic Production of Bearing Wood.*—It is obvious that, without the regular development of fruit spurs and bearing wood, it is impossible to produce large crops. The new bearing wood must be so situated that it may from its position be able to receive the necessary light and warmth from the sun, which go to the production of good fruit. Cutting back laterals for renewal tends to produce bearing wood and in the case of the peach and nectarine especially, which only bear on the new wood of the last year's growth, old wood has to be removed to make room for the new.

3. *Regular Bearing of the Trees.*—Left to itself, a fruit tree will bear

heavy crops one year and probably none the next. It exhausts itself and must take time to recuperate before it can attempt to bear a big crop again. Pruned every winter, judgment is used in thinning out superfluous and weakly-looking bearing wood and in cutting back strong growths covered with possible fruit-bearing spurs, so as to allow a portion of the excess growth which nature has provided to remain. Even then it will be found that heavy thinning of fruit may have to be done.

4. *The Production of a Tree of the Shape Desired.*—The most desirable shape for a fruit tree is that which affords protection from the sun, and such trees must of necessity be grown with a short trunk. At planting, the trees are cut down to about 20 inches in height and the resulting branches are trained outwards and upwards so that the sun may not be able to reach the trunk. The pruner should carry in his mind's eye the form of tree he desires eventually to own and make his cuts accordingly; if this is done the result is usually satisfactory.

5. *Sunshine and Light.*—Light and air are as necessary to the health of the tree as they are to the pruner himself. The arrangement of the topmost branches must be such as to admit both in sufficient quantity. The recognition of this is what has led to the adoption of the open-centre system for some kinds of trees, the fact having been realised that, without sun and warmth, colour would be lacking in the fruit. The open centre may not always be regarded with favour and when that is the case provision must be made by the careful spacing of the branches for the admission of sunlight so that it may penetrate to the lower interior branches of the tree.

6. *Improvement in Size and Colour.*—Improvement in size of fruit is attained by regular pruning. A tree with long, straggling branches will bring forth small fruit, which may reach to the very end of a branch liable to be blown about by wind, and may damage, not only the fruit it carries, but other fruit with which it may come in contact. By pruning, the energies of the tree are conserved, the pits, kernels, pulp and rind, which would have gone to the production of perhaps 40 small and probably sunburnt fruits of little value, are distributed between eight or ten decent specimens. Medium-sized and large fruits are always of greater value than small, undersized stuff.

So much *for* pruning. The methods adopted by various orchardists to attain the end desired may and do vary greatly. The pruning of fruit trees by rule of thumb is an unintelligent proceeding, the reasons for the various cuts made must be looked for and the desired end always be kept in view. An old Californian acquaintance of the author's insisted on apricots always being pruned so as to leave a fork, *i.e.*, each winter the growth of the previous season was cut

back so as to leave *two* branches instead of one. In the course of a few years so many branches had been formed that there was no room for the entrance of light and air. Another man insisted on the "single-stem" system; instead of leaving a fork, he left only *one* growth; he had too few branches in his trees. The intelligent pruner would take a leaf out of each book and produce a decent tree.

Pruning tools.—For general purposes a pruning shears is a necessity. No commercial orchard can be tackled with the old-fashioned

RESULTS OF NON-PRUNING AND NON-THINNING OF FRUIT.

[*Photo by H. B. Terry.*

pruning knife, though for garden purposes and small cuts nothing equals it. When many thousands of trees have to be pruned, rapidity of work is essential and can only be attained by the use of the shears. The best are made by the Sheffield Shears Co. and "Reiser" of Courcelles, Switzerland, next come the French-made shears which they term "sécateurs." Last come those made in America and Germany.

A pruning saw for use in the larger limbs is also needed Of the various makes offered, the best is the "Pacific," an American-made saw; it is light, handy and capable of good and quick work.

Before discussing pruning generally, it may be as well to mention those names which are usually given to the various parts of the

tree, and to remember that, pruned annually, it becomes an artificial and not a natural growth, produced for the special purpose of growing fruit which is intended to be sold for revenue production. If a fruit tree, such as an apricot, could speak, it would probably say that its first object in life was the reproduction of its species; it would delight in the production of immense crops of fruit and regard the *seed* as of far more importance than the pulp which encases it, and with which it is provided by nature to assist in its germination after it has fallen, as it would if left alone, to the ground.

The seed, after planting, develops both below and above ground and produces roots, trunk and branches. Trees naturally produce tap roots which strike deeply into the soil. Nursery practice and the transplanting from seed bed to nursery and thence to the orchard have done away with the tap root by cutting it off, and this is step No. 1 in the making of an artificial tree.

Above ground, the tree develops a trunk and branches. The orchardist decides that his tree must have a low head, and so he cuts off the stem to about the height of his knee and starts the branches from there—step No. 2 in the artificial tree.

Afterwards the branches are cut short and trained in the direction decided upon by the grower and the artificial tree is eventually complete.

The root system of a tree may be divided into main roots, growing somewhat horizontally but with a downward tendency; laterals, proceeding from these main roots; fibrous roots, attached to the laterals, and, lastly, the root-hairs whose function it is to take up the life-giving food in solution in the soil.

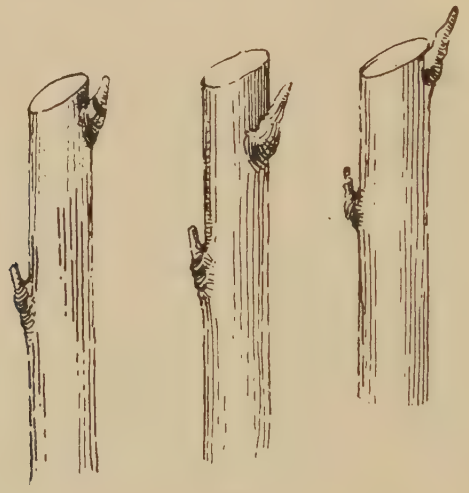
The trunk proceeds from the roots above ground, from it spring the main branches, from them secondary branches, laterals and fruit-spurs. The arrangement much resembles the root-system below ground.

Suckers and water sprouts.—The style of tree most popular in the Union to-day is that known as the " Goblet " or " Open Centre." By the adoption of this form of tree many advantages are claimed. It is possible, by reducing or confining the number of main limbs of the tree to four or five at the most and maintaining them as single stems with only fruit-spurs and a few lateral growths, to concentrate all the root energy capable of supporting a tree having a dozen branches into the limited number mentioned. The result of this is the production of the very largest and choicest specimens of peaches, plums and nectarines, and it is these which have made the Western Province of the Cape famous as a producer of some of the finest stone fruits in the world.

A similar style of tree with double the number of branches would simply double the quantity of fruit of a good, merchantable quality,

but when the branches are allowed to become too thick the size and quality of the fruit deteriorate.

In actual pruning practice, it is well to endeavour to make each cut in the right way. Cutting to a bud should be done as shown, neither allowing too much nor too little wood to remain above the bud. Always make a sloping cut, never one straight across the branch, yet it should not be made with too sharp a slant, or the wood at the point may easily break and is not sufficiently strong to support any new growth if a bud should be left on it. A little practice will make the cutting to a bud quite easy, it may take a



CUTTING TO A BUD.

1. Correct distance. 2. Too much wood left. 3. Too little wood left.

little time before one can work quickly, but eventually the use of the shears and cutting just in the right place become a habit.

The " cutting to a bud " has for its aim the growth of a branch from that particular bud in the direction desired, and while this object is often secured it by no means always happens that a growth appears at the right spot. Then the next best possible branch must be taken in hand for cutting in a similar way, for it is the production of branches in the direction they are required to take which shapes the tree in accordance with one's ideas.

It is generally advisable to cut to an outside bud when pruning most trees, but with the apricot and any other tree with wood of a brittle nature the *inside* bud should be chosen, as the liability to break at a certain point is less when this is done. Another exception

is made when the branches to be pruned are growing in too horizontal a position.

All branches should grow upwards and outwards and should be trained to the same sloping angle, more especially the outer ones, as the appearance of the trees is improved when this is done, and this counts. In instances where the tendency of branches is to be too upright, the practice of cutting to an outside bud should always be observed and when a tree is of spreading habit, cutting to an inside one must be the rule. Many pear and some apple trees have in their youth a strong tendency to an upright growth. This may be corrected by tying the leading branches down a little, but if left alone they will, when heavy crops are borne, open out naturally with the weight of the fruit.

All ordinary cuts of an inch or more in diameter should be painted over with some cheap paint. When main branches are taken away from the trunk of the tree, the wound should be covered with hot wax, which should be renewed when necessary. Neglect of this precaution may lead to the loss of a tree. Decay may set in at the site of the open wound and travel downwards into the centre of the trunk.

When making any cut with the intention of completely removing the branch, sever it cleanly and closely up to the spot from which it has grown, leave no stubs. They are unsightly, and may also start to decay and so injure the tree. Further, when a stub is left, it takes a long time for the ordinary growth of the bark to cover it over, whereas if cut away properly the damage is completely out of sight in a couple of years at the most. It is not customary when pruning and neither is it necessary when this work is done annually to cut into wood of two years' growth. On the wood of last season one may at once see the bud it may be desired to cut to, but when one cuts into two-year-old wood it is hard to know where to do it. In any case new growths may be depended upon to start out just from the wrong direction.

In actual pruning practice, it is a good plan when approaching the tree to be dealt with first of all to have a good look at it from all sides and decide whether there are too many branches, either main or secondary; if so they should be removed first, taking out all those which cross or interfere with other branches, and also the weak-looking ones, leaving only those which are healthy, in sufficient numbers to yield a decent crop of fruit. The next step is to cut back any laterals over a foot in length and, lastly, to cut back the main and secondary branches to the length required.

There are different ideas with regard to the quantity of wood to be left on a young tree at the first two or three prunings. Experience has shown that for the formation of a fruit tree which may be

asked to bear annual crops of a couple of hundred pounds weight of fruit, pruning must be on solid lines. This means that the cutting back of the main branches during the first few years must be fairly severe—not needlessly heroic; there is no need to cut back the branches of the first year's growth to 9 or 10 inches as was formerly done, possibly 18 inches would be nearer the mark, with slightly longer lengths during the two following years, much naturally depends on the amount of growth put on during the first season, but in any event a strong scaffolding *must* be provided on which the future tree may rest secure when labouring under heavy burdens of fruit.

If trees are not pruned at planting time, their future is unlikely to be either a long or a profitable one, and if long, weedy growths are left as a foundation on which to build up the future tree the eventual results will be very little better. The open centre system of pruning is particularly suited to the *peach* and *nectarine ;* the habit of growth of these two trees is identical. It is applicable also to plums, pears, apples and apricots, and may be secured in the following manner. At planting time trees are cut back some 20 inches, and if they have no small lateral branches, they look very much like whip-sticks stuck in the ground. Should there be any laterals, it may be well to leave three or four, but they should each be cut back to within a couple of inches of the stem of the tree; these may carry buds, which will grow out and become main branches for the tree. If they have no buds in evidence, it is likely that one will appear at the axil of the lateral and start from there. If no laterals are growing on the young trees, the buds which will appear in the Spring, covering the little trees with soft green foliage, must be rubbed off with the exception of three or perhaps four, and these must be selected so as to have them placed round the stem at a distance of about 4 inches apart, each to grow in such a direction as will eventually go to form a tree with a symmetrical shape. The lowest of these may be about a foot from the ground, the uppermost near the top of the stem. Not more than three branches are needed, but growers often allow four or five to grow out, so that in case of accidental breakages they may still have three branches to make a start with.

At the end of the first year's growth, the treatment with regard to the length of wood to be left must differ in accordance with the amount put on during the growing season. This is less in the Western Province of the Cape than in other parts of the Union, and it follows that harder cutting back is necessary there in order to force the growth during the next season than in the Transvaal and other parts where it is more rapid. If about one-third of the growth of the three main limbs is left at the first year's pruning, with any few small laterals which have appeared, it may be accepted

that such a length will not be far out. During the second growing season two limbs should be allowed to start from each of the three original ones, making six in all; these will throw out laterals and fruit spurs. The tops may be pinched back in December or January if growth appears to be too rampant, and the branches straggly. This tends to produce a sturdier habit. At the second pruning there will be six main branches with laterals and fruit spurs to be dealt with, the main branches may again be cut back to about one-third of the growth put on, more or less, according to the vigour of the trees. On the peach and nectarine short laterals may be allowed to remain, and any fruit-spurs which may have appeared; some little fruit may be expected next season.

The third pruning will find, instead of six main branches, at least twelve, and probably more may have to be dealt with. Those left should be so arranged that the outward trend of the branches is assured. At the same time those which are allowed to remain should be left as far as possible parallel with each other round the outside of the tree and not cut with one branch pointing outwards and the other inwards. This makes for a tree with a hollow centre. The interior of the tree will most likely be filled up with young growths or suckers of a quick-growing, tender nature. All these must be removed during December or January, but fruit bearing, small laterals should be left, care being taken to shorten in all over 8 inches in length, allowing a few fruit buds to remain. Next year's crop of stone fruits should be worth handling.

With twelve main branches it is assumed that the foundation of the tree is formed and that further pruning may be continued on lines similar to those set forth. A crop of suckers and water sprouts will appear in the centre of the trees annually and these must be removed. It will always be easy to find a lateral which will be growing outwards in the right direction, and the most likely of these should be selected to continue the main branches of the tree.

Future pruning will necessitate a further increase in the number of branches and this must be left to the discretion of the pruner, the main object being to have a sufficient number to bear heavy crops of fruit without undue crowding and sufficient room in the centre of the tree to admit sunlight and air. Never leave long, thin lateral twig growths, but cut back such annually, leaving a bud or two to carry a little fruit. The development of small spurs and laterals should be encouraged all over the trees; they help to provide shade and keep the branches in a healthy condition by the constant sap flow engendered by their presence.

With age, the annual growth of branches gradually lessens and as a consequence the work of pruning becomes less arduous. In

the case of peaches and nectarines, fruit-bearing spurs and laterals require to be cut back *every year* to a few buds, and if this practice is followed regularly it is hard to say to what age a peach tree may not remain profitable.

Renovating Old Trees.—When from old age or neglect a peach or nectarine tree no longer bears profitable crops of fruit, it may be given a new and profitable lease of life by the complete removal of every branch, cutting them off (with a saw) to within two or three feet of the trunk of the tree, leaving it and a few stubs only. The cuts should be covered over with hot grafting wax and what is left of the tree should be whitewashed in order to avoid danger from sunscald. Within three years a completely new head will have formed and a further period of fruit bearing may be anticipated. Judgment must, of course, be used in selecting the branches which are to be allowed to grow and all others should be cut off. Pruning of trees in this condition should not be of a severe nature. The same treatment may be meted out to old plum, pear and apricot trees, as a rule not with the signal success which attends the renovation of the peach. Work of this kind is not appreciated by the apple, which rarely responds.

Summer Pruning.—The practice of summer pruning cannot be considered a general one at present. It is, as a rule, resorted to for two or three reasons.

First, to increase the sturdy growth and vigour of young orchard trees; secondly, to induce fruiting habits, and, lastly, to help reduce the winter pruning to some extent.

It may be said that summer pruning is of recent introduction, as it appears to have been first adopted in California with the object of inducing the Moorpark apricot to produce regular crops of fruit annually (which was not accomplished).

In young orchards, especially in those parts of the Union where growth is most rapid, trees often persist in sending out many more branches than are needed; the removal of these by cutting them completely out tends to strengthen those which remain. These in turn will grow to be quite out of bounds unless subjected to pruning during the growing period.

Such work as is needed may be done by pinching off the top of the young branches with the thumb and finger. This may be done in December and if necessary repeated in February, the activity of the trees is often continued as late as March. This class of work is necessary principally on trees three years old and under, but may with advantage continue on those of greater age.

Summer pruning with the object of promoting bearing should be confined to those trees which appear to need it. Usually it takes the form of topping the growths with the object of inducing the pro-

duction of fruit spurs, and this is often quite satisfactory. It does not do away with winter work, as, owing to the presence of so much foliage, it is impossible to see what cuts are necessary and where to make them. This class of pruning is done after the fruit has been gathered, roughly speaking during January and February, depending on the locality.

Root pruning is about the last resort of the orchardist in his efforts to secure the bearing of an unproductive tree. It is also utilised in the endeavour to confine dwarf trees to the size limit which the owner may have in mind. In modern commercial methods of cultivating an orchard a good many of the smaller roots are cut during the annual ploughing of the land and thus slight root pruning takes place. When, however, trees are " root pruned " with the definite object of making them bear, it is customary to dig a trench round the trees so as to cut fully half of the roots away. This means that the top of the tree loses considerable vitality, its vigour in the matter of wood production is impaired and in many instances attention is turned to the production of fruiting wood. In fact, the tree receives a shock and so puts forth an extra effort at reproduction by means of a crop, and this is just what the grower wants; as the roots grow again, the tree does not revert to its unfruitful state, but continues its habits of good bearing.

Trees which do not require regular Annual Pruning

The Cherry may be treated during the first three years of its life after planting out in the orchard much in the same way as other young fruit trees are, submitting to the annual pruning in July in the ordinary way. The object to be attained is chiefly that of forming some stable foundation for the branches which will eventually develop and to start the tree off in such a way that it may shape itself with some regard to symmetry of form.

Later pruning of the cherry should be confined to the removal of such limbs as may be wrongly placed and cross and interfere with each other, or where there are too many branches. Each unwanted growth should be cleanly cut away from its spot of origin at its base, and the wound should be painted over. Any cutting back of the cherry as it gets on in years is liable to be followed by gumming, and this is one of those diseases to which this tree is most susceptible.

The Prune.—This tree used to be subjected to an annual pruning in South Africa when first introduced, but since the end of the last century it has been found unwise to continue this work. For heavy and regular fruiting, it appears best to leave the prune entirely alone and not touch it with a knive after it is three years old.

Of course, any broken branches must be taken out and if there are too many limbs and the tree appears to be too thick, these must be removed. All those dealt with should be cut completely away at the base and the wound painted over. It is possible that an occasional year's crop may be missed, owing to the tendency of all unpruned trees to take a rest after bearing very prolific crops, but the regular annual pruning of the prune has resulted in very light crops indeed.

The Fig.—Very little pruning is done on the fig tree and indeed very little is needed. Like all soft and large pithed trees it is better when left alone. There are times, however, when the top of a tree may grow to be too thick and some branches should be removed so as to admit the penetration of air and sunlight. Very occasionally it is topped and pruned in the ordinary way. When this does happen the tree responds with a vigorous growth of young branches. Generally speaking, when pruning a fig tree it is best to remove the branch entirely rather than to cut it back with the idea of pushing out further growth.

The Quince.—More quinces are grown in hedge form in South Africa than in any other way. The hedges are rarely subjected to pruning, except perhaps that which they may get at the hands of a garden hedge clippers. In the few quince orchards we have, pruning is not carried on in an extreme manner. The harder a quince tree is cut back the less fruit it is likely to bear. Left entirely alone after the first few years, satisfactory results follow. Summer pruning and the opening up of the centre of the tree to some extent tend to make the quince bear fairly regularly.

The Mango.—The mango is never pruned excepting when, on occasion, it may be necessary to remove a few branches which have been injured by frost, or in some other manner. Most mango trees go through life without having made the acquaintance of a knife. The only pruning the author has ever seen done to the mango tree has been root pruning, and that with the object of getting the tree to alter its bad habits of non-bearing into good ones of bearing regular crops. Many mango trees have an unfortunate habit of forgetting how to bear regular crops after getting to be about 10 or 12 years old, and the root pruning has sometimes had the desired effect. Girdling and cincturing the branches, as is done with the Zante currant, have also been tried but without much success.

The Avocado.—This is one of the trees which has been neglected as far as pruning is concerned in South Africa. Naturally a quick grower, it would appear necessary to cut back long straggling branches, but little attempt is ever made to attend to this matter. With the recent introduction of many varieties previously unknown here, it is probable that more study will be given to the tree and

its requirements, particularly including pruning. The object should be to produce a tree with short stem and fairly widely-spreading head, with branches spread so as to preclude any crowding together and to admit light and air. Particular attention appears to be necessary as to the time at which any anticipated work in the way of pruning should be undertaken on account of the peculiar blossoming habits of the tree.

The Guava.—The guava will stand any amount of cutting about and may be pruned at the will of its owner either annually, biennially or not at all. As a rule, all guava trees here seem to have had no pruning done, though there are a few which have received attention at times. Left entirely alone, the tree is likely to bear more fruit than when pruned, and as this, after all, is the principal object in growing the guava, it is reasonable to assume that most guava trees will remain unpruned. It may be cut to the ground with frost annually, but will shoot up again in the Spring of the year. Cut down to a mere stub, it will recover and become a big tree again in two or three years.

Persimmons may be pruned for the first three years of their growth, much as any ordinary deciduous fruit tree such as a peach or a plum. The object is to shape them so that they may carry their loads of fruit safely at some later date. One-third of the growth may be left on the three or four main branches which are allowed to remain at the first year's pruning, and about half at the next two prunings. The training and shaping of the tree will depend on the variety, and there are large numbers of these. The treatment of the upright growers is to assist them to spread and open themselves out a little, and with the spreading ones to endeavour to grow them more in an upright direction.

The Olive.—No olive tree requires to be pruned more frequently than every other year, excepting during the first few years of its life, during which period it, like other trees, has to be trained with some idea as to framing the future head.

Thinning out may be necessary during the fourth and following years if growth is rampant and too many branches appear, but the heading back of the tree should be avoided.

The Litchi.—There are so few litchis in the Union and the demands made on them are on so large a scale for propagating purposes that no attention has been paid to the question of pruning.

The wood is particularly brittle, and branches are liable to be injured and even to be blown off during high winds. The only pruning applied to the litchi within the experience of the author is the removal of such injured branches by cutting them completely off at the point from which they start out from the tree. Inquiry into methods in vogue in other countries has proved futile; pruning

the litchi seems to be one of those things which simply is not done.

The Loquat is another of those trees which require a little shaping and may be pruned with that object in view for the first few years of its life. As a rule, this tree naturally assumes a symmetrical appearance and much interference is not needed. The removal of crossing and interfering branches by eliminating them entirely and the cutting away of any dead and injured branches are about all that is done. There are occasions where a little thinning out is of benefit to the tree, and it should be remembered that it bears on the end of the present season's growth. Thinning the clusters of fruit will always increase the size of those specimens which are allowed to remain.

The Almond.—It is on record in California that an almond tree, treated from infancy and pruned exactly in the same way as a peach tree, cutting back almost every little twig, has borne heavy crops annually.

The author is honestly afraid to advise any such treatment here. Local custom is to leave the tree entirely alone, after the shaping which it has to undergo, during the first three years of its life. The exceptions to this rule are when too many limbs occur and have not room within the tree to develop properly; then it is policy to remove some of them and naturally those selected for removal will be the weaklings, or those which may be out of place, rubbing against other branches and interfering with their growth. As a fact, pruning, or the lack of it, is not so great a factor in the successful production of an almond crop as are correct pollination methods.

The Walnut.—Walnuts, like most of the other trees dealt with here, require no pruning after the tree is once properly shaped, and often it may be seen on its arrival from the nursery to be without the slightest need of any alteration. Walnut trees, like all other fruit trees, require to have but one stem or trunk. This is more needed, perhaps, in the case of a walnut than other trees. Old English gardeners say "The walnut must stand on one leg," and this is quite so.

A little thinning out of branches may sometimes be necessary, and actual pruning by cutting back into sound wood may be done should the trees suffer a set-back from sharp frosts. When this happens, it is as well to cut to the next lateral, growing in the right direction, as sometimes the branch may develop a tendency to continue dying back.

The Pecan.—Very few pecans are to be found in South Africa. On those which are here, no pruning has ever been done, nor does it appear to be necessary. The pecan tree has more the habit of

a forest than an orchard tree, and will probably thrive best when left untouched with the knife.

Thinning Fruit

This is one of the operations which is imperative if fruit of the best quality and size is to be secured.

Amongst the advanced growers in the Western Province of the Cape it is justly regarded as one of the most important of the steps to be taken to secure fruit such as they desire.

In some other parts of the Union, thinning of fruit is looked upon as being little short of criminal, a stock argument being that a hail-storm may come and do all thinning (and more) than is required. Whether lack of energy or fear of cost has anything to do with this, the author knows not.

It may be, of course, that cost of the work, which is also of a slow, tedious nature, has some bearing on the slackness in some quarters in the matter of thinning fruit. It is not to be conceived that our best growers, many of whom depend on their fruit crops for a living, would thin it out year after year if they did not find the operation a profitable one.

In the annual winter pruning of most deciduous fruit trees a good deal of work in thinning may be saved by the judicious cutting back of the bearing wood; the removal of a large quantity of this, no matter how skilfully done, will not absolve the grower from the necessity of a certain amount of thinning.

Apart from the production of fine fruit, there are other aspects from which this matter should be regarded; for instance, the well-being of the trees themselves. If all the fruit carried were allowed to remain on the trees, the whole of their energies would be dissipated in attempting to develop and ripen a very large crop of small, undersized specimens to the exclusion of putting out fruiting material for next year's crop, in the way of fruit spurs and laterals. That would mean the receiving of one crop of small fruit which most likely would realise a very low price, as compared with that which fine fruit would fetch, and the probable loss of a profitable crop in the succeeding year. It is recognised that when left alone in an unpruned state most fruit trees bear only in alternate years, and this is not in accordance with business ideas.

The exhaustion of a tree caused by the ripening of large quantities of small fruit necessitates a rest for recuperative purposes; this cannot be as good for a tree as the bearing of regular crops of fruit in moderate quantities which entails no strain on the constitution. Even supposing that the weight of a large crop of small fruit was approximately the same as that of a much smaller number of fine

fruits, the drain on the tree would be far greater in the first instance, as the production and ripening of the solid matter contained in the fruit in the way of pips and kernels are far more exhausting than the effort to produce pulp alone. From all points of view it may be accepted that the act of thinning is beneficial.

The peach tree is more frequently pruned nowadays when in blossom than at any other period. This is due largely to the fact that by the judicious removal of superfluous blooms with the shears much of the thinning work to be done at a later date is obviated. This is the only tree that custom has decided should be so treated.

Apricots and plums are pruned during the winter season when bare of leaves, but if very heavy bloom is present it is possible to relieve matters by cutting away any twigs or laterals which are palpably overburdened during the blossoming period, and no harm will ensue.

The time for actual thinning of fruit is when the pits are still soft enough to be easily cut through with a knife, *i.e.*, before the development of wood in the pits and the kernel is still almost unformed. At that time neither of these has made any actual call for the supply of its chief chemical constituents.

Different classes of fruit necessarily require different treatment. The disposition of the crop after gathering must be taken into consideration. The finest fruit, that which is needed for export, is thinned heavily, whilst that for local business, canning and drying will not receive such drastic treatment. Most workers, when thinning fruit for the first time, are afraid to pull off anything like enough; they have to be shown first that when four or more peaches grow on a stem the removal of all but two is a necessity, and these two should be left, not on the same side, but on different sides of the stem. If two are left on the same side, it is very likely that they will be so close together that they will touch before getting full grown, and both would be spoiled for export purposes. Many peaches are exported up to 3 inches in diameter and it will be seen that to allow them to remain at a less distance than 6 inches would be fatal to the production of a peach of perfect shape, size and colour.

Some varieties of the peach, and more especially the yellow-fleshed varieties, have a habit of bearing double peaches, Fosters and Crawfords are about the worst offenders; these should always be removed when thinning, as well as any other fruits which, owing to some untoward circumstance, may be misshapen. Apricots nearly always require lots of thinning; the trees, generally speaking, when grown under favourable conditions, are tremendous bearers, and apricots the size of marbles would be the result if the crop were not properly thinned. This fruit is perhaps more liable to damage

from late frosts than any other, and these may occur before the pits have hardened. In areas subject to frosts of this nature, it may be wise to allow the operation of thinning to wait a little, as it would be so much waste of time and money should a frost come along after work of thinning was completed.

Japanese plums are also tremendous bearers. Sometimes some kinds, such, for instance, as "Kelsey," may be seen with more plums than leaves on them, unless heavily thinned; the market value of such fruit as this is likely to be very little and the damage to the trees considerable. To leave them evenly placed at about 4 inches apart throughout the tree may be said to be fairly satisfactory, but of course much depends on the vigour of the tree and the purpose for which the crop is destined.

After the thinner has been at work for a day or two, he will become so accustomed to and expert in it, that he will be able to use both hands to it, and this is of great assistance in the matter of speed.

Pears and apples also require to be thinned. Some kinds of pears, like Louise Bonne, bear their fruit naturally in clusters, and these need not be drastically thinned. When clusters are found on other varieties, and especially on those which are recognised as bearers of large-sized fruit, it is better to do the thing thoroughly and thin out a cluster to one or two pears only.

Tip-bearing apples such as Rome Beauty should not be encouraged in their bad habits, and if any are to be left on the tips of the branches, there should not be more than one. Thinning the apple pays just as well as the thinning of any other fruit and on regular good cropping trees single specimens should be the rule and not the exception.

The work may be done with a pair of shears or a pair of grape scissors. The best time to thin is when the fruit is still small, just under the size of a walnut. On those trees which are known as shy bearers no need exists for the use of drastic measures.

If apples of a reasonable size, like Jonathan and Wémmershoek, are left at about 4 inches apart on the tree and larger ones, like Ohenimuri and Rome Beauty, at about 6 inches, it will be found that sufficient have been left to secure a good crop.

CHAPTER XII

THE APPLE

It has been demonstrated frequently and very clearly that apples of good quality can be produced in South Africa.

The "King of Fruits," as it is called so often, has a wide range of climates in which it attains a certain degree of perfection. It is to be found growing and fruiting in a satisfactory manner in each of the four provinces which go to make up the Union of South Africa, and each province claims to produce the best quality fruit.

The tree is supposed to be indigenous to a cold climate and by some to have its earliest representatives in the wild Crab Apple trees which are to be found over large portions of Northern Europe. Others state that the original home of the apple has still to be found; whilst some authors, in writing of the subject, tell us that the apple is indigenous somewhere between Persia and the shores of the Black and Caspian seas.

The general opinion is that, because the apple tree is a native of colder climates, it cannot possibly produce fruit in South Africa equal in colour, flavour and quality to that which is grown, let us say, in Canada, America, Russia, Tasmania and other celebrated apple-producing countries. Yet the fact remains that apples of very excellent quality are grown not only in South Africa, but in some of the warmer States of America and Australia. A good deal depends on the locality selected, the soil, exposure and immediate surroundings of the orchard. The varieties of fruit produced will also be somewhat different from those which flourish under colder conditions.

Interest has been widely awakened during the last few years in the production of the apple in South Africa and large plantings have taken place all over the Union –perhaps the most extensive being in the Transvaal, Orange Free State, and the Western Province of the Cape, in the order mentioned. The Eastern Province and Natal have also not been idle and can point to many beautiful and thrifty orchards.

Encouragement was lent by the different pre-Union Governments through the various Departments of Agriculture and by the formation of experimental orchards, and many varieties of apples, as well as other fruits, were tested. The pioneers of commercial

apple growing in the Cape were the Cape Orchard Company, who planted thousands of trees near Worcester.

In the Orange Free State, Mr. H. E. V. Pickstone planted some 50,000 trees near Clocolan, and both in the Transvaal and the Orange Free State the late Senator S. Marks was responsible for the planting of orchards which to-day, some thirty years after, are amongst the most successful in the Union.

It is, however, within the last seven or eight years that remarkable developments have been made, and this is due to the sub-dividing of large tracts of land into 10- and 20-acre plots by land companies, who undertake to plant and maintain apple orchards for the first five years for a sum to be paid in easy monthly or half-yearly instalments. Hundreds of thousands of apple trees have been planted as a direct result of this policy, and these will, in a few years, so materially increase the output as to enable an export business of some magnitude to materialise.

Commercial apple orcharding, although already existing to a limited extent, has undoubtedly great scope for expansion. Here are a few factors which make for its development.

Primarily comes our geographical situation and the fact that, although we do and shall continue to grow many of the same varieties as are produced in Tasmania and Australia, we are half the distance from the market that these countries are, we are able, therefore, to score, in that our fruit gets on the market earlier than theirs and our freight charges should be correspondingly less.

Land suitable for apples is to be obtained at low prices compared with those asked (and secured) elsewhere.

Climatic conditions, as regards rainfall, favour the production, over a large part of South Africa, of an apple with extra good keeping qualities.

Low rates of freight from orchard to coast and thence oversea are in existence and the organisation known as "The Fruit Exchange," amongst its various activities, is constantly on the look-out as to how to improve all matters connected with the development of the fruit industry.

It may be remarked that the varieties principally grown in South Africa number comparatively few. Out of the hundreds which have been introduced, tested and, in some cases, approved of, there are scarcely a dozen which figure amongst large commercial plantings. This means that the sorts most widely planted have been decided on because of the profit attached to growing them. It is not the highest quality which is most extensively set out, but rather the most profitable—both from a bearing and a selling point of view. In some instances, indeed, varieties regarded as somewhat inferior have been found to be amongst the most profitable, and

this is especially the case with some of those kinds which are looked upon as distinctly South African.

Very early apples never have good carrying qualities and do not reach the European market in safety. For this reason, the numbers of these are strictly limited. What is sought after in commercial plantings is chiefly an apple of good colour, shape, flavour and carrying qualities and the varieties most in favour now generally embody those attributes.

Districts for the Apple.—Broadly speaking, the areas most suitable for the apple may be divided as follows:—

The coastal districts, such as may be found in the Western Province of the Cape, the Eastern Province in Lower Albany and the "Long Kloof" in the south.

Portions of Natal, Griqualand East, the Transkei and the higher portions of the Bokveld, Orange Free State and Transvaal where, at an altitude of from 4000 to 6000 feet may be found almost limitless areas which, subject to wise selection, afford ideal conditions for apple growing.

The tree is deciduous: that is, it sheds its leaves in winter, and this being its natural habit, it is only reasonable to suppose that such climatic conditions as are to be found in the districts mentioned—having warm summers and cold winters—are more likely to suit the needs of the tree than warmer and perhaps frostless areas, where, as cold in winter time is never severe, the tendency of the tree is to keep on growing with scarcely any dropping of leaves and no recuperative period of rest. It is not reasonable to suppose that either the tree or fruit of the apple grown under such conditions can compete with those produced in areas which afford —owing to the cold months of winter -that period of rest which is necessary to all fruit trees of a deciduous nature.

There is an old saying that "You can work a willing horse to death," and this may be applied to the apple tree, for wherever it may be placed it does its best and may apparently thrive for a time under unnatural conditions and adverse circumstances.

An ideal apple tree should attain large proportions and live for fifty years and over, and such trees as these can only be found when they are grown in suitable soils and climates where their natural requirements are to be found. It is as unreasonable to plant oranges on the high veld as to plant apples in the low veld, and quite impossible to find both apples and oranges of the best quality growing side by side.

It will be evident, therefore, that the districts named are mentioned because the climates to be found there are such as may be regarded as being as near perfection for the growth of the apple as we can find in South Africa. Yet even in these areas it is

necessary to act with circumspection—the selection of an unsuitable site is sufficient to preclude the success of an orchard; to make what should prove a profitable undertaking a disastrous one.

On the high veld, especially, there are pitfalls for the unwary. There is what is known as the "Mist Belt" in the Transvaal, where, if one leaves a pair of boots in the room at night without a fire, they are white with mildew in the morning. Apple growing in the "Mist Belt" means constant spraying against the mildews and fungus diseases which are to be found in such surroundings.

TWENTY-FIVE-YEAR-OLD WHITE WINTER PEARMAIN TREE. MACCAUVLEI.
[*Photo by E. Brandmuller.*

Hailstorms occur on the high veld, and, in the past, perhaps caused some hesitation about investing in an apple proposition in that area. It is not too much to say that to-day less consideration is given to hail as a drawback, and it is questionable whether the nervousness about high veld planting was every fully justified. Certainly, it has not prevented the development of the apple industry in those parts, for our largest apple orchards in South Africa are on the high veld of the Transvaal. Between Johannesburg, on the north, and Vereeniging 40 miles south, at an altitude of some 5000 feet on an average, hundreds of thousands of thrifty apple trees may be found. Apart from the hail question, conditions on the high veld are ideal for the production of first-class

apples. Rain falls during the growing season, promoting and assisting growth. In the autumn months, when fruit is ripe and picking and packing are going on, the climate is matchless. In winter, bright days, not too warm; cold nights and atmosphere clear, crisp and dry, afford ideal conditions, not only for the production of a first-class apple, but also for all orchard work in connection with pruning, ploughing, etc. Carried out under these conditions, work becomes a pleasure.

There are many theories held both by the older population and new-comers in connection with hailstorms and their incidence. It is generally believed that they follow the contour of the hills and that certain spots get hail whenever a storm comes. It is also a general belief that other and more favoured places enjoy an immunity from these storms. The selection, therefore, of a site for an apple orchard becomes a matter of much importance. Inquiries should be made locally and all possible precautions taken to avoid " Hail Belts," as they are termed. Outcrops of " Oude Klip," or ironstone, are supposed to attract electric storms, but apart from that altogether, sites of that nature should be avoided from a soil point of view.

In addition to the precautions necessary in the selection of a site, the problem of how to minimise or avoid loss when hail actually falls calls for consideration.

A rather large orchard in the Eastern Transvaal had been planted—the owner having been warned in the first place that hail was probable. In due time, the trees bore fruit and also, in due course, a hailstorm came along and damaged the crop. The owner objected to this most strenuously and asked for advice as to how to prevent future loss. The reply was by use of a system of wire-netting, which will be permanent, and work out at about £240 per acre, or by the use of " Parahails," which have not been thoroughly tested in South Africa and therefore cannot be recommended with confidence. In the end, the Great War intervened and nothing was done. The apple orchard is still unprotected and it is generally accepted that the site is badly situated for hailstorms -yet crops come regularly, and even when a bad storm occurs there is a certain amount of revenue and when no hail comes—even there it does not fall every year—the orchard is a profitable one.

More recently a modified form of netting the trees has been practised and arrangements have been made for the netting in of each individual tree separately. The success of this system has yet to be demonstrated. The cost is much less than the figures previously named, being about 7*s.* 6*d.* per tree.

Recently, in April 1924 to be exact, one of the largest of the

commercial apple undertakings in the Transvaal imported a specialist in cider-making from Somersetshire, England. A large factory was built with all the latest improvements in the way of presses, vats, tanks, etc., and thus a new outlet has been found for dealing with any apple crop which has been rendered unsightly and unsaleable by hail marks and so unfit for ordinary sale for either cooking or dessert purposes.

In addition to cider-making, many thousands of pounds of hail-marked apples have been either evaporated by the use of an evaporating machine or sun-dried. Mr. Pickstone's dehydrator at Clocolan is capable of producing many tons of dried apples in a season and the sun-dried apples made from hail-marked fruit by Mr. E. J. L. Woodland on the " Witfontein Estate " 30 miles south of Johannesburg are as near perfection as dried apples can be.

It is apparent, therefore, that, even under very adverse circumstances, the entire loss of a crop is a rare occurrence. There is no wish to make it appear that hailstorms are desirable, but there is certainly a clear intention to place both sides of the question before prospective apple growers.

No guarantee can be given at any time, or at any place on the high veld, that hailstorms will not occur. The most favoured localities are occasionally subjected to a visitation—yet in spite of all that has been said the planting of apple orchards continues and the acreage under this fruit is steadily on the increase. The total number of apple trees in the Union of South Africa, according to the Agricultural Census of 1921, was:

Bearing Trees	*Non-bearing Trees*
1,419,410,	1,051,680,

or a total of 2,471,090 against a total of 2,171,326 in 1918. Roughly speaking, this means an annual increase in the Union of 100,000 trees per annum. We have now some 25,000 acres under apples. The question of whether or not the production of apples will be overdone is giving many growers in America and Canada some anxiety. As far back as 1910, the State of Pennsylvania alone had as many *non-bearing* apple trees as we in South Africa have now altogether.

Our export has scarcely begun; when it does, we shall find our chief competitors in Australia and Tasmania. It has been pointed out that we are favourably situated for competition.

Situations and Exposures for the Apple.—It is extremely necessary to study these matters thoroughly. In most cases, the house in which an orchardist is going to make his home will be on or near the site of his orchard; so that convenience to transport facilities, not

only for produce, but also from a domestic point of view, is very important. As a rule, one has to pay more for land near a town, and sometimes it is worth doing.

The initial cost of the land does not mean as much as many people think, when at the end of ten or fifteen years an orchard comes to be worth a couple of hundred pounds an acre, or more. It is a sound proposition to pay a good price for good land rather than a low one for land of doubtful suitability.

Many of the slopes of the foothills are too steep for apple growing, and when such are chosen, there is always the risk of the washing

SHELTER BELT OF SINGLE ROW OF PINES. MACCAUVLEI.

[*Photo by E. Brandmuller.*

away of the soil and the formation of unsightly gullies which render the working of the orchard difficult. It also means harder work for man and beast in cultivating, ploughing, etc.

A cold, heavy, stiff clay is to be avoided and equally so are all situations where one cannot keep the whole of the orchard clean by the use of a plough and harrow, owing to stony outcrops and ridges. Again, a situation which lies too low and from which water cannot properly drain off is unsuitable. For choice, the site to select is one which is not too steep. There are many gently undulating hill slopes which offer good sites with perfect drainage and large areas of level land in the valleys which are very suitable

for the apple. The trees should not be exposed to high winds. Shelter from near-by hills is desirable, or some kind of shelter must be provided by the planting of windbreaks. An exposure to the north and east is, as a rule, the best throughout the whole of the Union. The locality in which the orchard is planted has much influence in the selection of a site. On the cold high veld, one would naturally select as warm a corner as possible; whilst in those sections of the apple districts towards the coast, where warmer conditions prevail, we can understand that the apple tree would appreciate a cool breeze occasionally.

Protection from hot winds is important also, and is especially desirable in those districts where south-east winds prevail during the summer months and there is a likelihood of losing a portion of a crop if an orchard is in too exposed a position. Many mistakes have been made in planting in such areas. Exposed hill sides should be avoided, for it is a fact that the best apple yields, as indeed crops of any kind of fruit, are to be found in *sheltered situations*. It is here that local knowledge is really of great value and new settlers should make a point of seeking it sedulously from the older inhabitants. The author has often received most valuable advice in this way.

Soils for the Apple.—Some of the best soils in the world are to be found in South Africa, also some of the poorest. There are extensive tracts especially in the Transvaal and the Orange Free State which offer all that is required in the way of apple soil. Perhaps the best of all are to be found in the dark grey loams—not what we call here " turf ground " and in California is termed " adobe " —but rather a soil approaching the dark red and chocolate loams in texture, but slightly stronger, heavier and grey in colour, almost black when wet. These soils are deep and often carry lime nodules. They are easy to work if taken at the proper time, and on such as these may be found some of the finest apple and also pear trees in South Africa. They require little or no fertiliser for a good many years and will continue to yield large crops when ligher soils would require an annual outlay for manures of some kind. Such is the very best type of soil to select for the apple.

There are also many instances of apple orchards which have proved profitable on other classes of soil; one is at Vereeniging, in which trees appear to be growing on pure sand, and which is one of the best paying in South Africa, but lots of money have been spent in improving it. The red loam soils, especially when they have a moderate amount of clay mixed with them, afford an excellent home for an apple tree, but in all cases there are two important things to look for, and they are: depth of soil and good drainage. Sites to avoid are such as are underlaid with an impervious iron-

stone gravel, " Oude Klip " or ironstone, or clay of a heavy nature, such as is termed " pot clay."

Whilst the apple can put up with and thrive on a soil naturally moist, it is fatal to ask it to grow in a site which is water-logged. If any doubt exists, it is as well to test prospective apple soils by putting down a few holes, either by digging or the use of that most useful tool a post-hole auger. No land carrying stones in quantity which appear on the surface and continue down into the sub-soil is fit for apples. It is imperative that cultivation of the land be done by ploughing and not by digging. To plough a stony outcrop is impossible. On the other hand, what may appear to be a stony piece of land may carry them only on the surface. These are called " floating " and when cleared off leave the land fit for the plough. There are also instances where stones have been struck at a depth of 2 or 3 feet or more in land which supports fine trees. The roots of a tree will find their way into all sorts of impossible places, and where roots can penetrate and secure sufficient plant food even amongst rocks the tree will thrive. It is claimed that underground stones in not unreasonable quantities help to provide good drainage.

Rainfall and Water Supply.—Irrigation of the apple orchard is unusual in South Africa. There are instances where apple trees mixed with other kinds of trees in a home orchard get water when the others do, whether they want it or not. They usually respond by yielding fruit of an abnormal size, and though this may be satisfactory for domestic use, it has little commercial value as compared with fruit of medium to large, or even less than medium size.

In some of the warmer districts, where rain falls principally in the summer months, and occasionally forgets to do so, it has been found advisable to provide a water supply for irrigation purposes. Without it, the trees would, on occasions, have a very bad time. This use of irrigation has been resorted to principally in the Eastern Province of the Cape.

Still, it may be said, speaking generally, that the apple, in South Africa, is grown without irrigation. This implies that a sufficient supply of water is provided by the annual rainfall. Just how much is necessary to keep an apple tree in good growing condition, healthy and capable of bearing good crops, depends on circumstances, and no figure can be given which would apply to the whole of South Africa. Provided proper methods of cultivation of the land are in use, it may be said that the apple tree, planted in the bush veld in the north and the Eastern Province in the south, where evaporation is rapid and the rain falls in summer—can get along with a rainfall of 26 inches when precipitation occurs

favourably, that is, spread over a good portion of the growing period, from September to March.

In the apple-growing districts of the Transvaal, the Orange Free State and Natal highlands with a summer rainfall but less rapid evaporation and occasional mists, 25 inches of rain well distributed should prove sufficient and in the Western Province of the Cape, with a certain amount of atmospheric moisture, in excess of that to be found in the districts mentioned previously, it should be possible to produce good trees and good fruit on less. As a rule, rainfall is not so short in that district. It is usually over 30 inches and falls in winter.

Some growers like, if they can, to give their trees a watering at blooming time, and there is a good deal to be said for this practice. It may happen that the seasonal rainfall is late in making its appearance or may come in scanty showers at long intervals. This results in an extended period of blossoming, of sickly-looking half-opened buds, which do not admit of the cross-pollination which is so important a factor in the production of regular and large crops. One good irrigation would prove an efficient remedy for this state of affairs.

Propagation of the Apple.—Thirty years back, apple trees in South Africa were, when purchased from a nurseryman, either budded or grafted in what is commonly called "sweet stock," meaning thereby young trees grown from the seeds of some strong growing variety of apple. New sorts introduced from England, Holland or America were budded on the stocks in use in the country from which they came, and in each case it was found that both roots and branches were subject to the attacks of woolly aphis, or as it is termed in this country "American Blight."

The seedling and other trees already here were also badly attacked by the same pest. In fact, so serious was the state of affairs that many trees died as a result. There is no doubt that the insect in question is extremely harmful to the tree if it is left alone or the orchard neglected. It is almost equally injurious in other countries and would doubtless have killed trees in both Australia and America if it had been allowed to go unmolested.

In both those countries, and in others where the apple-growing business had reached large proportions, it had been customary and necessary to spray the trees at intervals of about twenty-one days from the time of blooming onwards in order to check the ravages of the codling moth. This spraying had the double effect of controlling the spread both of codling moth and, to a certain extent, also the woolly aphis. In South Africa, the codling moth was practically unknown, and as a consequence, the practice of spraying the apple or any other kind of tree was non-existent. It

is doubtful if there were a dozen spray pumps in the country. That being so, the woolly aphis had its own way and certainly did an enormous amount of damage. Many people who had apple trees dug them out rather than be bothered with them.

On the author's arrival at the Cape in 1898 one of the first novel sights he came across was the grafting of various popular varieties of apples on to roots of the Northern Spy. Inquiry revealed both cause and effect. The Northern Spy and a few other kinds of apple have a bark so hard both on the roots and branches that the aphis cannot puncture it. These kinds are, therefore, immune from the attentions of this particular pest, which attacks both the roots and branches of the tree. By the use of the roots of the Northern Spy as a stock, it became possible to confine the attacks of the insect to those portions of the tree which are above ground, as the trunk and branches, and these could be kept free from the pest by means of spraying. Methods of propagating the apple on Northern Spy or any other resistant stock, such as Winter Majetin or Cliff's Seedlings, are as follows:—

(*a*) *By Root Cutting.*—Roots of the thickness of a lead pencil and upwards are cut into 6-inch lengths and planted in nursery rows similarly to cuttings, with the upper portion of the roots almost level with the surface of the soil. The surrounding earth is then drawn over, covering them about 1 inch deep. They must be kept moderately moist and may produce from one to six shoots from each cutting by earthing up, just as one does potatoes. These shoots are induced to form roots and are then taken off and planted in nursery rows.

(*b*) *By Grafted Rooted Cuttings.*—Cuttings of stocks are made about 5 or 6 inches long on to which are grafted, by means of the whip graft, short pieces of blight-proof apple roots. The root-grafted cuttings are planted in nursery rows and covered with soil the same as the root cuttings. When growth commences, this soil is carefully drawn away. A " take " of 95% may be looked for.

(*c*) *Cuttings with Root Help.*—Experience has shown that, in some instances, cuttings do not root freely and very often the supply of roots strong enough for grafting being too small, cuttings are made 6 to 8 inches long. An inch or two from the base of the cutting a slit is made in it, in an upward direction; into this slit a piece of the root is inserted which has previously been cut to a wedge shape at its upper end, and firmly tied with raffia. The cutting is then planted and treated in the same way as advocated previously. The small piece of root inserted is sufficient to provide the cutting with nutriment

until it strikes roots of its own. By this method, many stocks have been produced. The secret of success in all three methods described is the covering of the cuttings with earth to check transpiration of moisture and the keeping of the soil in a moderately damp condition.

All three methods can be used in the open ground, but if shelter sheds or beds are used, the results are better. In this case, the trees have to be transplanted the following season. Room is, however, much economised as the cuttings are planted very closely.

(*d*) *Layers.*—Fairly strong trees are planted in rows and cut back close to the surface of the soil. Numerous shoots will appear which the following season are treated as layers in the usual way. This method is slow but sure. Instead of waiting until next season, the shoots which are the result of the cutting back of the tree can be earthed up when big enough and treated just like those mentioned under (*a*). Roots will be formed the first season and the shoots can be cut off the parent trees or stools the following winter. The majority of them will be strong enough for grafting in the Spring, and all of them, under fair treatment, be fit to be budded the following fall with Northern Spy buds. These are again budded with the desired variety when big enough. In a well-regulated nursery, once a store of blight-proof stocks has been established, methods of propagation are as follows:—

When trees are lifted, ready for sale and dispatch, some few of the roots strong enough for grafting are cut off and utilised as roots for further grafting. The tops of the trees supply wood for grafting purposes.

Root Layering.—Large numbers of stocks are produced by this means. Roots of healthy Northern Spy trees are cut off and laid in the ground horizontally and covered with soil to a depth of some 3 or 4 inches; such roots may be of any length if laid in longitudinally. When laid transversely, they are usually cut to about 16 inches in length and laid in just like the rungs of a ladder without the sides. Plants from these result in strong, healthy young trees which are severed with enough of the parent roots attached to ensure vigorous growths.

Australia and New Zealand were the first users of Northern Spy as a stock on a large scale. The original Spy stocks introduced into South Africa arrived in 1893 from New Zealand for Mr. H. E. V. Pickstone, who also brought in, at the same time, stocks of the Winter Majetin. These latter he discarded as not being a success. In those days, Mr. Pickstone's firm was the first to

recommend the use of the Northern Spy for stock purposes and he later received the support of the then Cape entomologist (Mr. C. P. Lounsbury), who recognised their desirability in this country.

The propagation of apples on blight-proof stocks has become a practice to a certain extent throughout the Union, but notwithstanding the use of the above methods it has been found impossible to produce a supply sufficient for our needs, and consequently we have had to import large numbers of stocks from Australia annually. This practice is now discontinued. There is no reason why we should not grow all the stocks of blight-proof apples we want.

Although resort to the use of these has become general, there has, of late years, sprung up a very strong feeling amongst some of our most progressive growers against their further use. It is claimed that the root of the Northern Spy variety is not capable of either producing or supporting a tree which will grow to be large and long-lived. That the Spy roots are weaklings and lacking in foraging power, and that, generally, it is sounder policy to graft on seedlings from some robust sweet stock or other which will produce big, strong, long-lived progeny. There is much to be said for this contention. It is certain that there are no big trees in South Africa worked on Northern Spy stock. It has not been in use sufficiently long. On the other hand, it is not difficult to find really fine old apple trees growing either as seedlings or budded to some strong-growing local stock. It is a pity that these are subject to the attack of the aphis, but it is quite impossible to raise trees which shall be blight-proof from seed. Experiments in this direction at the Potchefstroom Experimental Orchard, about 1916, showed that from 5000 seeds of Northern Spy planted there was not one grown from them which was at all resistant.

Those who object to the use of the Northern Spy as a stock argue that it has steadily deteriorated in vitality on account of the unnatural manner of propagation necessary to its production. There is no doubt whatever that Nature's methods of growing trees from seed are by far the best.

Further, that pest of the apple grower, the codling moth, has now become distributed almost all over the country and its control demands frequent sprayings of all commercial apple orchards. This practice certainly helps to keep down the woolly aphis, and under present circumstances there is far less risk in the use of common seedling apple stocks than formerly.

The Dutch sweet and sour apples are amongst the most vigorous we have, attaining the dimensions of a good-sized oak tree, and it is quite possible that seedlings of these may be called upon to produce trees for future planting. That it is by far a more vigorous tree than the Northern Spy cannot be denied, and the extreme

simplicity of propagation from seeds, as compared with the complicated methods one has to adopt in the case of the Northern Spy, is an inducement to its further use.

Quite recently, something entirely new in the way of apple stocks has been noticed. For years past it has been customary, as has been shown, to use every endeavour to produce apple trees on roots which should be perfectly blight-proof. It was recognised that it was possible to keep the tops of the trees fairly free from the aphides by means of spraying.

The idea had never occurred to anyone to graft varieties such as the Northern Spy, or Cliff's Seedling or any other blight-proof variety on roots of common sweet or sour Boer Apple.

Some of the finest apple trees in the country are to be found on the farm of Mr. Walker, "St. Ford," near Bethlehem, Orange Free State. They are about thirty years old, and possibly 30 feet or more in height. They bear heavy and regular crops of Northern Spy apples; there is not a sign of aphis near the tops of the trees—but they are worked on common Boer Apple stocks which show blight in plenty. The reverse of the ordinary usage is here shown and exceptionally fine trees are the result. The aphis does *not* have any serious effect on the vitality of the trees when it is confined to the roots; on the other hand, these Northern Spy apples, grown in this way, bear regularly, started bearing at five years old instead of eight to ten as is usual with this variety, and, so Mr. Walker states, produce seedlings which are perfectly blight-proof and which also start bearing at some four or five years of age. Further work of an experimental nature is needed to verify all these claims, but enough has been shown to justify exhaustive tests.

The practice of growing dwarf trees is not in use to any extent in South Africa—in fact, it is unknown from a commercial point of view. Yet there are occasions when dwarf trees are desirable. These occur when cramped space conditions make it necessary, such as may be found in gardens in towns where land is of higher value than under ordinary circumstances. To produce dwarf trees, it is customary to use what is known as the Paradise stock—one of the most susceptible to woolly aphis, and this renders it necessary to first of all bud Paradise on to Northern Spy roots and afterwards to bud the Paradise with the desired variety. This is called "Double Working."

Planting Apple Orchards.—There are a few points in connection with the planting of an apple orchard which are important:—

1. The varieties to select.
2. The distance and method of planting.
3. Cross pollination.

It is a mistake to select varieties for planting by looking over a nurseryman's list. All the apples mentioned there are good for some purpose or other, or some district or other. What is of most interest to the orchardist is what varieties will suit his district and conditions best; which of them are the most regular and heavy bearers; the most in demand on the markets, and the most resistant to disease. Local assistance is often of the greatest use in this matter. Inquiry from market agents will inform you of the kind of apples they want and can sell the best, but it does not follow that they can all be grown in the same orchard.

The question has also to be borne in mind as to the final destination of the crop, whether for home or export trade. If the former, then the planting of early, medium and late varieties may be considered. If the latter, all early kinds, without exception, must be cut out; they have not the necessary carrying qualities and any export to the European markets will result in failure. This is a clear enough statement and is the result of long experience.

No apple should be exported from South Africa which ripens prior to Jonathan, *without any exception.* Amongst these kinds which will in the future be found profitable for export will most certainly be Rome Beauty, Ohenimuri, London Pippin, Rokewood, Commerce, Statesman, Adams, and White Winter Pearmain. From those districts which can grow them, such as Elgin in the Cape, are Cox's Orange Pippin and Ribston Pippin. All but the two last named are apples which have a wide range and are to be found doing well in nearly every province of the Union.

The different systems of planting have already been described and it is for the grower to decide on the one most suitable for his needs. The commonest and most in use is the old-fashioned method of planting the trees in squares. The only possible objection to the use of this is that it is less economical of space than others. However, here in South Africa there are lots of room and orchard land is fairly cheap, so that the few extra trees secured per acre by the adoption of other systems of planting are not of as great moment as if the land were scarce and dear. There is another view-point from which the matter of planting may be studied, and that is, that the better and more liberally you treat your trees the better they will treat you. Given plenty of soil in which roots may extend, the better and finer trees you may expect.

There is also the question of convenience in ploughing, cultivating, spraying, etc. By the use of the square method of planting, it is possible to cultivate between the rows of trees four different ways—two at right angles and two diagonally. By no other system of planting can this be done.

Apples are generally planted in South Africa at a distance of 20

to 25 feet apart. It appears that the 20 feet planting is, as a rule, quite far enough apart for all varieties which are worked on Northern Spy stock. A better distance for free-growing and wide-spreading trees is 24 feet. It seems questionable whether it is worth while to plant at a greater distance than this in South Africa. At any rate, if it should be considered necessary to allow more room owing to the disuse of the Northern Spy as a stock, then the advisability of planting a fifth tree in the centre of each four is manifest. Say you plant apple trees at 30 feet apart on the square system, there is ample space and soil in the centre for the growing of some quick-bearing tree, such as Japanese plum or peach, as a catch crop. The difficult part with regard to them comes afterwards, in the natural unwillingness to discard and dig out a profitable tree at the right time, which, of course, is when the root development begins to interfere with the roots of the apple trees. However, the use of the ground in the centre of the square, when trees are planted out at 30 feet apart, is fully justified and may be utilised for moderate intercropping with such crops as beans, peas, melons and pumpkins. A few rows of mealies may be allowed if kept sufficiently well away from the permanent tree as to admit of cultivation, and will do no harm.

Cross Pollination.—This has, in recent years, come to be regarded, and rightly so, as a matter of the greatest importance in planting an orchard. Although the trees are not mixed up now anyhow, as once they were in the days of careless or unscientific orcharding, it is certainly wise to plant, let us say, six rows of a kind together, alternating them with other varieties suitable for pollination purposes right through the plantation. Insect life, especially the bee, has much to do with the fertilising of one blossom with the pollen of another and the keeping of bees should accompany the establishing of an orchard where possible. In many districts, wild bees will do all that is needful, but they are not always present.

In order that successful cross-pollination of the blossoms shall take place, it is, of course, necessary that the dates of blossoming of the varieties which are beneficially affected should coincide with the fertilising pollen-giving sorts which have been provided for the purpose. Numbers of different varieties are what is termed "self-fertile," meaning that the blossoms of such will set and mature fruit without extraneous assistance. Others are "self-sterile," meaning that without the aid of pollen from the flower of some other variety they are unable to set fruit properly. As a consequence, good crops from trees such as these do not materialise. It is not the case, however, that any pollen from *any* bloom will render those on another tree fertile. Certain varieties have affinities and without them cross-pollination by any other variety is of less

avail. Thus, it has been found that the York Imperial is self-sterile and bears little fruit unless it has the Wemmers Hoek for a neighbour. The White Winter Pearmain and Ohenimuri should be planted together.

The following table, giving dates of blossoming, has been supplied by Mr. H. B. Terry, the Resident Horticulturist at the Potchefstroom School of Agriculture. The dates given will naturally vary from those in some other districts, as the trees may be affected by climatic conditions.

Blossoming Period of Apples at Government Experimental Orchard, Potchefstroom, for Three Years.

Variety.	Period of bloom, 1916.	Period of bloom, 1917.	Period of bloom, 1918.
Alfriston	28/ 9/16—26/10/16	13/ 9/17— 5/10/17	23/ 9/18— 2/10/18
Cleopatra	20/ 9/16—20/10/16	10/ 9/17—29/ 9/17	20/ 9/18— 2/10/18
Cliff's Seedling	15/ 9/16—27/ 9/16	6/ 9/17—24/ 9/17	10/ 9/18—21/ 9/18
Delicious		20/ 9/17— 9/10/17	28/ 9/18—18/10/18
Emperor Alexander	3/10/16—23/10/16	26/ 9/17—15/10/17	15/ 9/18—30/ 9/18
Fameuse	20/ 9/16—14/10/16	18/ 9/17— 3/10/17	29/ 9/18—17/10/18
Gloria Mundi	27/ 9/16—28/10/16	12/ 9/17— 4/10/17	23/ 9/18— 2/10/18
Gravenstein	20/ 9/16—22/10/16	10/ 9/17—30/ 9/17	21/ 9/18—30/ 9/18
Irish Peach	22/ 9/16—18/10/16	9/ 9/17— 2/10/17	20/ 9/18—30/ 9/18
Jonathan	28/ 9/16—23/10/16	10/ 9/17— 8/10/17	21/ 9/18—10/10/18
King of Pippins	27/ 9/16—25/10/16	10/ 9/17— 7/10/17	22/ 9/18— 5/10/18
Lady's Finger	8/ 9/16— 3/10/16	9/ 9/17—25/ 9/17	27/ 9/18—12/10/18
Lord Suffield	27/ 9/16—26/10/16	11/ 9/17— 3/10/17	27/ 9/18— 8/10/18
Lane's P. Albert	5/10/16—25/10/16	18/ 9/17—11/10/17	29/ 9/18—18/10/18
Lord Wolseley	8/10/16—20/10/16	22/ 9/17—15/10/17	29/ 9/18— 9/10/18
Lord Carrington	26/ 8/16—17/ 9/16	30/ 8/17— 8/ 9/17	4/ 9/18—18/ 9/18
London Pippin	5/10/16—23/10/16	21/ 9/17—17/10/17	27/ 9/18— 4/10/18
Missouri Pippin	25/ 9/16—19/10/16	7/10/17—17/10/17	2/10/18—12/10/18
Nickajack	27/ 9/16—20/10/16	17/ 9/17—12/10/17	25/ 9/18— 4/10/18
Ohenimuri	26/ 9/16—20/10/16	9/ 9/17— 2/10/17	22/ 9/18— 1/10/18
Prince Alfred	19/ 9/16—17/10/16	9/ 9/17—29/ 9/17	30/ 9/18—19/10/18
Rhode Island G.	25/ 9/16—23/10/16	10/ 9/17— 2/10/17	25/ 9/18— 3/10/18
Rome Beauty	11/ 9/16—10/10/16	17/ 9/17— 2/10/17	20/ 9/18—16/10/18
Rokewood	27/ 9/16—24/10/16	10/ 9/17— 1/10/17	24/ 9/18— 4/10/18
Reinette de Canada	5/10/16—23/10/16	18/ 9/17—12/10/17	30/ 9/18—14/10/18
Sharp's Early	25/ 8/16—20/ 9/16	4/ 9/17—18/ 9/17	7/ 9/18—22/10/18
Tom Putt	25/ 9/16—20/10/16	12/ 9/17— 3/10/17	22/ 9/18— 1/10/18
Tulis	18/ 9/16— 7/10/16	9/ 9/17—22/ 9/17	10/ 9/18—27/ 9/18
King of T. Country	4/10/16—30/10/16	11/ 9/17— 1/10/17	30/ 9/18—15/10/18
Versfeld	10/9/16— 8/10/16	10/ 9/17— 2/10/17	22/ 9/18—30/ 9/18
Wealthy	5/10/16—30/10/16	15/ 9/17— 3/10/17	24/ 9/18— 3/10/18
W. W. Pearmain	26/ 9/16—22/10/16	9/ 9/17—30/ 9/17	22/ 9/18—30/ 9/18
York Imperial	27/ 9/16—25/10/16	21/ 9/17—12/10/17	28/ 9/18— 8/10/18

Pruning the Apple.—The pruning of the apple commences the day on which it is planted, when the top is reduced in order that, in addition to other considerations, the tree may make a sturdy growth. Low heading of the apple is compulsory in all climates where the sun is sufficiently hot to form an ever-present danger from " sun scald " of the stems, and thus one never sees here apple trees with trunks 6 feet high before a branch is allowed to grow out, as is frequently the case in Europe.

FOUNDATION BRANCHES OF A TWENTY-FIVE-YEAR-OLD ROME BEAUTY TREE. MACCAUVLEI.

[*Photo by E. Brandmuller.*

Just how far above the ground the lowest branch should be allowed to grow out from the trunk is a matter of little moment, provided that they afford shade for it in later years. Our customs of ploughing and cross ploughing, leaving a square of ground untouched from 3 to 4 feet from the trunk of the tree to be dug later by hand, is quite a different system from that practised, let us say, in Australia or California, where labour is high priced and one has to plough as close to the trees as possible so that hand work may be reduced to a minimum. Conditions being as they are, it is of no moment whether the first branch starts out at 8 or 12 inches above the ground. What is of importance, is, after the tree has been planted, only three branches should be allowed to

form during the first year and these should be placed well round the trunk—not all starting at one spot, but with a space of 4 or 5 inches between them so that the natural growth should be symmetrical and that they should not form a weak spot on the trunk, as would be the case if they all started out within an inch or two of each other.

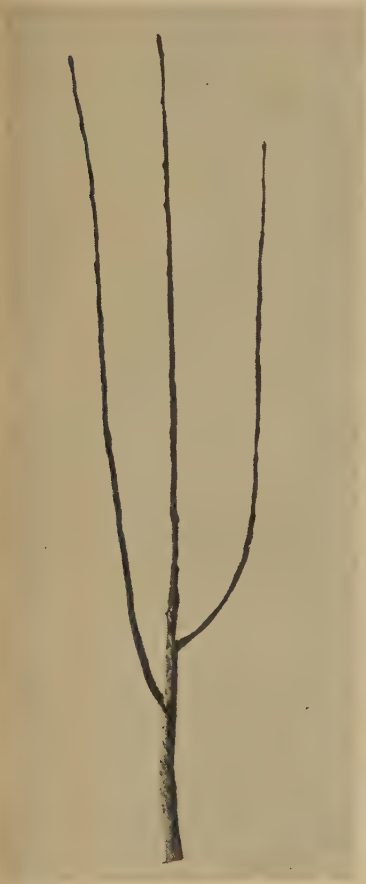
APPLE TREE CUT BACK AFTER PLANTING.
[*Photo by H. B. Terry.*

Consider what an enormous strain there would be in a few years' time, when the trees are bearing heavy crops, on just that one spot where three or even two branches start, and it is patent that it is much easier for a tree to be ruined by the loss of a limb than would be the case when each branch begins life at properly spaced distances. Many apple trees yield 50*s*. worth of fruit per annum. The capital value of such trees is very considerable.

Apple trees are usually bought from the nurseryman in the shape of a long single stem, without branches, of from 4 to 6 feet in height. Occasionally one may get two-year-old trees; these have been cut off and headed back at the conventional height of about 20 inches, and a head of three branches allowed to form. Probably the one-year-old makes the best tree; the buyer is able to suit himself as to the height at which he starts its branches and there is less of the root system left behind in the nursery than in the case of older trees; always, as soon as the trees are planted, they have to be cut back, all to one height. This ensures that future uniformity of appearance in the orchard which is so desirable.

When the buds begin to grow, the strongest and most suitably placed are allowed to remain and eventually become the foundation branches of the tree. Having left three, these will probably grow from 2 to 4 feet in length the first season and there is no particular gain in shortening these back by severe summer pruning. The

ends of the branches may be pinched back with the finger and thumb late in January and if more main branches should have grown out, these can be removed with a clean cut close up to the



GROWTH OF APPLE TREE AT END OF FIRST YEAR.
[*Photo by H. B. Terry.*

APPLE TREE AFTER SECOND WINTER'S PRUNING.
[*Photo by H. B. Terry.*

stem. In June or July, the winter pruning must be done, and this merely consists of cutting off from one-third to one-half of the previous season's growth; the stronger and more robust the growth, the more may be left. When growth is inclined to be weak, remove

fully two-thirds; the harder you cut, the more you may expect the tree to grow at this stage.

The second year's growth will start from the three branches left and should be strong and vigorous. From these three branches, many others will start and the little tree will be overburdened with too many. Remove those which are undesirable in January or February, cutting them off close to the stem, and leaving no stub. This will give an extra flow of sap to those which are left. The branches to remove as undesirable are those which are the weakest or grow in an awkward position; those to remain are the ones which follow the course of the previous year's growth and extend in the same direction. Should the tree be naturally of a spreading habit, it is considered the correct thing to cut to an inside bud; if of an upright habit of growth, then one cuts to an outside bud. Winter pruning should leave the young apple tree with perhaps six branches instead of three, and a few twigs and laterals may also be left. About half of the year's growth of the main branches should be cut off.

The third year is also a year of vigorous growth, and among some of the earlier fruiting varieties such as Missouri Pippin and Rome Beauty a few fruit spurs are thrown out. Summer pruning is necessary for thinning purposes principally, though pinching back is also occasionally practised. Winter pruning will find a dozen or more branches and here, it may be said, the number of these will not increase quite as systematically as has been the case previously. An indefinite increase of branches on the two to one principle would find the tree eventually such a mass of wood and leaves that the entrance of light and air would almost be cut off. It is from this and the following years that what may be termed " the Single Stem " system of pruning should be considered. That means the retention of that portion of the main branch which has continued to grow in the original direction and the encouraging of fruit spurs and conveniently placed laterals on these branches. The constant cutting back of the leading branches of the tree is discontinued when it reaches six years of age. By that time its permanent foundational structure and shape have been determined and nothing remains but to keep the centre of the tree fairly open. The basket shape and frame of the peach and nectarine are not desirable. There should be room for laterals and good fruit inside the tree as well as out: indeed, inside fruiting of the apple may be encouraged, as the overseas markets require a small to medium-sized apple and the tendency of our trees appears to be to produce always large fruit, so as large crops and smaller sizes go together, the entire denudation of the inside of an apple tree of its natural branches is unwise and unnecessary.

With the bearing stage reached, the continued annual winter pruning may largely be given up, as far as the topping of branches is concerned. The habits of growth of the different varieties should be studied and when not in accordance with and conducive to regular and fairly heavy bearing, some endeavour should be

APPLE TREE OF UPRIGHT GROWTH AFTER SIXTH PRUNING.
[*Photo by H. B. Terry.*

made to put things right. Such trees as Ohenimuri require little attention; they carry their fruit well distributed along the branches, but tip bearers like Rome Beauty and Versveld require constant watching. Topping must be judiciously done until they have been induced to adopt better habits, and these, as sometimes in other cases, come, as a rule, with age.

The removal of interfering branches and any which grow in the wrong direction is necessary. Any surgical treatment, sometimes rendered necessary by the breaking of a limb in cultivation or from too heavy weight of fruit, or action of wind, should be attended to promptly and when removal is necessary, the branch must be cut off very closely up to the trunk and the wound painted over.

The practice of summer pruning as a means of inducing early fruiting or of encouraging shy bearers to get into better habits may also be dealt with. As a rule, the apple commences to bear

SIX-YEAR-OLD OHENIMURI TREES ON WALKER'S FRUIT FARMS NEAR JOHANNESBURG.

at an age which is quite early enough and there should not be any undue haste to force it into bearing before its natural period.

Briefly, no tree should commence to reproduce itself until maturity has been, to a certain extent at least, arrived at. Some kinds of apples naturally bear earlier than others, but it is safe to say that the very earliest bearers should not be allowed to make a start before being four years of age, and six years is young enough for a tree to begin bearing heavy crops. Any interference with the laws of nature invariably carries its own penalty and a young tree prematurely forced into bearing may respond by becoming sickly and unprofitable at a later period.

When strong, healthy, well-grown trees, of bearing age, only yield crops in an erratic manner, there is some excuse for inter-

ference and amongst the many nostrums which have been tried to make old healthy trees bear regular crops of fruit, that of summer pruning is by no means the worst to adopt. Summer pruning, with this object in view, should take place in December. Many an old apple and pear tree, especially the latter, has had the experience of having its bark hacked to pieces with hatchet or axe or has had dozens of rusty nails driven into it, or a large stone placed in its fork; its roots cut, or perhaps a wire ligature tied round its trunk, in order to compel it to do its duty.

There is a certain amount of common sense attached to the use of all these queer ways; the object to be attained, *i.e.*, the making of the trees to bear, is sought for by the same remedial measure, and that is the hindering of the sap flow. Most of the non-bearers are fine, well-grown trees; our hot climate, with its rainfall, acts as a forcing house. The sap travels rapidly, and rushes into the production of more wood growth at the expense of the development of fruiting wood. When the rapid flow of sap is, by the adoption of one or other of these means, controlled, and a slower movement is induced, the development of fruit spurs, laterals and fruiting wood is encouraged and as a result the tree bears. If all these methods have been tried without avail, the study of the necessary blossoms for cross-pollination must be taken up.

Cultivation and Fertilising.—The proper cultivation of all orchards and especially of an apple orchard is essential to success in climates such as we have in South Africa. The season of growth lasts from September to March, and, as we have seen, very little resort is made to irrigation; moisture, without which the tree could not grow, must therefore be maintained well within the reach of the roots. Each weed growing during the dry season must be looked on as an enemy, for it is extracting moisture from the land and so cultivation with weed-killing as an object has to be practised. No one accustomed to apple-growing in England and some other European countries can understand why so much ploughing, harrowing and cultivation take place in South Africa. They are used to seeing orchards in which grass grows the year round and do not see why the same should not be done here. It does not require a particularly keen observer to note the difference in growth between the trees in a weed-covered or grass-grown orchard in South Africa and those in a well-cultivated one. In the one case, the trees are healthy and vigorous, and in the other, sickly and languishing.

Clean cultivation should be practised during the dry season, not only for the destruction of weeds, but also as a means of retaining the moisture near the surface. There are times, however, when it is not possible to get implements and animals on the land; this is

during the rainy season, in the winter in the Western Province of the Cape, and in the summer in all other parts of the country. Then weeds grow apace and it is only when rain ceases that it is possible to plough. The turning under of a crop of weeds is of benefit to the land. By this means, if practised annually, a raw, hard soil becomes soft and mellow; the addition of the weeds and their decay provides humus and a small amount of fertilising constituents.

It is to crops of a leguminous nature that one has to look for the greatest actual benefit to the soil. It pays to grow them as producers of nitrogen, which they secure from the air, in addition to beneficial mechanical action. Only a very few orchardists plant legumes in their apple orchards; scarcely any do so in the northern areas of the Union. Not only do they *not* plant legumes, but frequently they neglect the very necessary function of adding any kind of manure to the land. The author has only too often seen apple orchards sickly and on the down grade for want of a little manure when there has been plenty on the farm. Ordinary stable manure is of the greatest value in an apple orchard. It may be used as freely and beneficially in the important apple districts of the south-west as in the north of the Union.

Usually, the addition of nitrogenous fertilisers, apart from cover crops and stable manure, is unnecessary for the apple. The use of guano is not desirable and scarcely ever necessary. If the soil contains only a moderate supply of lime, potash and phosphates, the growth of the apple should not be difficult. As a matter of fact, it is a most accommodating tree and will grow in any fairly decent soil. Our soils in South Africa are, as a rule, deficient in phosphoric acid, and this can be supplied by the use of superphosphates or ground bone. They should be applied either some time before or after stable or kraal manure. The quantity needed will depend on general soil conditions and the extent of the exhaustion of natural supplies. About 5 lb. per tree may be regarded as all that is necessary up to the age of nine or ten years and this is best applied by either scattering broadcast round the tree, 2 feet from the stem to 2 feet beyond the branches, or digging a trench 8 or 9 inches deep all round the tree, just as far as the branches spread, and sowing the fertiliser in that. August and September are the best months for this work, except in the Western Province, where May is the best month. Many soils do not require much fertilising until some few years after the trees are planted. The drain on any particular constituent does not become serious until fruit in large quantities is produced and then, unless the right fertiliser is given, the effects of overstrain on the tree become readily apparent; the fruit becomes smaller; growth to any extent

ceases and the tree has a generally woebegone appearance. At this stage, heavy pruning is sometimes recommended. This treatment, entirely suitable for the peach and apricot, is often fatal to the apple, and when the unfruitful stage is reached, manure and a fertiliser of the right type are the only means of salvation.

It is easy to see that it does not do to wait until the lack of manure is felt. The maintaining of the orchard soil in good heart by cover cropping with some legume such as Kaffir or velvet beans, and the judicious application of stable or kraal manure will go far to maintain the necessary fertility. When the heavy-bearing stage has been reached, the addition of potash and phosphates in some form is called for. If these are given in time, and the fertility of the soil maintained by their regular use, there will be no reduction of crops and no complaints of small fruit.

Thinning.—Very little thinning out of apples is done in South Africa. The general impression is that they will thin themselves or that hail will come and thin them, so that there is no need for work to be done in that direction. Besides, it costs money. Yet it pays to thin apples. Often we find bunches of six to eight or more, which, if they were left, might all develop; if they did, then there could not be one apple in the bunch of either decent shape or size.

True, there are many varieties which hardly ever overbear, but in many instances, and more particularly so in the tip-bearing varieties, overbearing is frequent. The removal of half or more than half of the crop is justified, and in the case of the bunches, these should be allowed to bear only one or two fruits instead of half a dozen. The tree is better able to continue a life of regular bearing activity if not compelled to yield fruit to the limit of its capacity. Breaking down of the branches is less likely to occur. It is useful to have a pair of scissors in the operation of thinning. One is then able to get at the individual fruits more readily when there are a large number in a bunch.

Picking.—Although the apple and pear are not classed as "soft fruits," yet the golden rule of handling each fruit as if it were an egg holds good. No fruit can submit to careless handling and realise top prices, and the apple is no exception. There is a right and a wrong way to pick apples; they must be fully developed and coloured—yet not quite ripe.

There are a few kinds which may be allowed to hang on the trees till the pips have become dark brown, but they are little grown in South Africa. The Wemmers Hoek variety hangs longer than any other we have without harm. If picked at too early a stage, before pips are brown all over, the apples are liable to shrivel up and are never as finely flavoured as they should be. If allowed

to hang too long on the tree, there is a tendency for the fruit to become woolly and lose its keeping qualities and flavour. So it is apparent that some judgment is necessary in order to know just when to pick apples. The study of the different varieties grown, the time of arrival at maturity and the exact stage of ripeness at which they may be picked is both interesting and profitable.

Early varieties are grown for local requirements only. An apple which ripens in time for the Christmas market is assured of a welcome and of good prices. Such are picked as soon as they become palatable enough to eat, without much regard to ripeness, though naturally the ripest and best flavoured fetch the highest figures. It is when one comes to the later ripening varieties that special care has to be taken in connection with the stage of ripeness at picking time. Fruit for storage or export must not, on any account, be over-ripe. Fine dry weather, such as is experienced during the fall and winter in the Transvaal and Orange Free State, is ideal for picking apples. No part of the fruit-growing world can offer better conditions. Apples picked in dull showery weather, often damp, sometimes wet, cannot be expected to keep as long as those which are gathered under the right conditions.

There is a right and a wrong way to pick an apple from the tree. If torn off roughly, or with a straight pull, the chances are that the stem will remain on the tree. An apple without a stem is not a perfect apple, either for show purposes or commercial use; there is a weak spot and an opening for disease germs and, as a rule, there are plenty of these about. The correct method is to give the fruit a half-pull and half twist in a lateral direction and place it carefully in the receptacle provided for the purpose.

Apples should be picked into buckets—tin for preference—the picker carrying his bucket with him. If the trees are too large, a ladder is used and the bucket has a hook with which to hang it on the ladder. When full, it is emptied (carefully) into a picking, or "lug box," as it is called. The practice has become general now of utilising empty paraffin and petrol cases for the purpose, and they answer very well when altered a little; one side of the case is made into the bottom of the box. What was the top is made into a side. Then across the top, at each end of the box, cleats are nailed 2 inches wide by $\frac{3}{4}$ inch deep. Then one may stand six or eight boxes one on the other, and not bruise the apples, provided the boxes are not too full. They should be hauled to the packing house on trolleys with springs and, when removed, should travel in a spring wagon of some kind and not any kind of vehicle, at any time, without springs.

The packing house should be situated as near the railway as possible. Indeed, both pack-houses and store-houses should be on

a siding if that can by any means be arranged. If that is out of the question, then the most convenient site must be selected.

Apples should be taken from the orchard and placed in the pack-house with as little delay as possible. The longer the time before they are safely under cover and in a uniform and moderately low temperature the greater the liability to damage from one cause or another. It does not pay to attempt storage of inferior apples at any time. The best apples pay for storage and small and medium sized fruit store best.

In connection with the pack-house, a fruit room may be associated. By this is meant a room in which storage of apples may take place for a moderate period without any attempt at refrigeration methods. Such a room may be used for the apples after they have passed out of the pack-house and are graded to size. It is best to do all grading of apples in the pack-house; it may be done as the fruit is brought in from the orchard, or the boxes may be stacked and the grading done later.

Size-grading machines are not in general use here yet, but there are a few, and Mr. Wallace, of Collingham, Grahamstown, and Mr. Rawbone, Oak Valley, Elgin, have quite useful ones. The use of apple-grading machinery will increase as our apple orchards extend and it is to be noted that good types of machines are now to be had.

Grading should take place for colour as well as size. Frequently comparatively little attention is given to this colour question, yet it is of importance in that apples well graded for colour present a far more attractive appearance and fetch better prices than those which are packed without regard to that feature.

The packages in use are either boxes or wooden trays. During the last twenty-five years the standard apple box has become smaller and smaller; originally measuring 24 × 12 × 10 inches, it became, in California, 22 × 11 × 10 inches in 1895. Later, the standard adopted in South Africa was 20 × 11 × 10 inches and now has been fixed at 18 × 11½ × 10 inches inside measurement. It is to be hoped that this is final. The first diminution in size was resorted to in the belief that no one would notice it and that the same prices would be realised for the smaller as had been obtained for the larger box. The one advantage of the present box in use is that it is a much more convenient package to handle.

The trays in use measure 18 × 12 inches, any depth required, according to the size of the apple. They contain but a single layer and are much in favour for local use. Holding from 24 to 30 or 40 apples, these trays are handy and a purchaser is often found for one who would decline to take home a large paper bag full of apples.

Packing a standard box of apples may be done in different ways: the diagonal is perhaps the favourite; but when only one sized box is in use, the adoption of that size is compulsory, and resort may be made to two or three different methods, as illustrated in the chapter on fruit export.

Apples for export should be offered at the docks in standard boxes only. The question of lining out the box with paper is one for the individual shipper to decide. The general appearance of the package is certainly enhanced by this practice. If the paper has a lace edge, so much the better; it is effective and inexpensive. The inside of the box is lined out; the bottom cover and the paper are brought up each side and turned over, so that when the box is packed the paper may be turned back over the fruit, just as one sees in the case of well-packed raisins and dried fruit. Paper is also sometimes laid between the layers of apples—this is optional; but the use of corrugated strawboards as box linings is unsightly and of little use. A well-packed box of apples needs nothing of that kind.

All apples for export should be wrapped in paper—not only on account of the fruit being kept clean, but to prevent rot going right through the box, as it might do if only one decayed specimen were present. Besides this, the use of paper makes packing easier; the fruit fits in better and shaking is less liable to occur. A paper similar to that used for wrapping oranges but of good quality is most suitable. It may be had both in Cape Town and Johannesburg at lower than imported prices and in all sizes. The use of pictorial end-labels is to be encouraged. They go to make the box of apples more attractive besides keeping the "brand" of the shipper in the public eye. In packing all kinds of fruit for distant shipment, rigidity of the product, once inside its receptacle, is imperative if it is to arrive at its destination in good order. It is necessary, therefore, to pack apples so that when the boxes are nailed down there is a slight bulge in the centre, just as one sees in a perfectly packed box of oranges. A press should be used if the work is of sufficient volume to warrant the expense. At the time of writing, the export of apples from South Africa is in its infancy, but it will rapidly expand.

Cold Storage of Apples.—This is in some few instances done on the farm. Where the quantity of fruit is sufficient to justify the expenditure, the erection of a building with a suitable plant for operating same is desirable. Profits on apples from cold storage are large, as may be realised when one buys that fruit in any of our big towns, let us say, in the months of July, August and September. In no other country in the world are prices of off-season apples so high. The ability to take advantage of these is rendered possible

by cold storage. Some dealers make a practice of buying all the apples they can secure of certain favourite varieties and storing them in some public cold storage. This is a source of considerable income to the dealer. In many instances, fruit is packed and placed in the cold storage in the ordinary standard box; these may be kept at a temperature of about 33° Fahr. from four to six months.

The Commercial Value of Different Varieties.—Mr. McEwan, in his useful book on "Fruit Growing" (Cole, Melbourne) gives the following points on which to judge the value of different varieties. He takes six principal headings and awards a maximum of five points under each as:—

Habit of growth	5
Colour	5
Cropping	5
Keeping and carrying	5
Disease resisting	5
Selling	5
	30

Habit of Growth includes vigour, good shape and hardiness.

Cropping would include regularity of yield, preference being given to a good average cropper rather than to one yielding enormous crops one season and none the next. (This is one of the points which depend on pollination, pruning, fertilising, shelter, etc.)—R. A. D.

Colour.—Points are given to apples with a rich attractive colour.

Keeping and Carrying.—These qualities invariably go together. Solid and tough-skinned fruit keeps and carries long distances in safety. This is a most essential quality when the object in view is an orchard of export fruit.

Disease Resisting.—This refers to those least subject to woolly aphis, bitter pit, mildew, etc.

Selling.—All other points count little if this one is a failure. However many good qualities an apple may have, they are not of much account if the apple will not sell.

Apples at Agricultural Shows

Suggestions for the Exhibitor.

1. All apples should be perfect in every particular; none should be without the stem.

2. No apple infected with any kind of insect pest or plant disease should be shown.

3. Apples should be true to type in shape and colour.
4. All apples should be correctly named.
5. They should be arranged, if in dishes, as a dish of *five* specimens, which should be uniform in size and colour.
6. Show fine fruit, but nothing abnormal should be included in a competition.
7. Place apples on dishes always with the *calyx* upwards and see that they retain as much of the natural bloom as possible.
8. Polishing the fruit disqualifies it.

If showing boxes of apples packed for export, remember all must be wrapped. Place the wrappers all to read in the same direction. See that the end labels and marking are in accordance with Government regulations. An attractive end-label goes a long way.

Packed Boxes not for export will look better with fruit unwrapped: Uniformity of size and colour are of the first importance.

Suggestions for the Judge.—When assisting the show committee in making out a prize list, insist on competitions only between the same varieties.

Examine *all* exhibits in a class, carefully throwing out the inferior ones until three only are left. These should be judged with score card, awarding points as follows:—

Shape, uniformity and trueness to type	10
Colour, typicalness	10
Size, fine, large, not abnormal, quality	10
Nomenclature, true to name	10
Perfection of display, bearing in mind general appearance, freedom from insect pests and plant diseases, cleanliness	10
	50

Score card for apples packed for export:—

General appearance	20
Wrapping, quality paper and design	10
Tightness of pack, alignment, placing	10
Nailing up, solidity, placing of nails, cleats	10
	50

Study courtesy to exhibitors *in excelsis.*

Take plenty of time over your work, you are but one, critics are many.

Give reason for any decision if called upon to do so.

Encourage unsuccessful exhibitors; next time they may be victors.

Keep an inexhaustible stock of patience on hand.

Varieties.—There are at least 1000 different named varieties of apple under cultivation in different parts of the world. In South Africa, to the author's knowledge, some 400 kinds have been grown and tested. There were over 200 kinds at the Government Experimental Farm at Cedara, Natal, and at least an equal number at the Transvaal Experimental Orchard at Potchefstroom. Many varieties of proved merit, both as to quality of fruit and bearing habits in other countries, proved useless here and we have adopted a large proportion of American sorts for the reason that they have proved more suitable to our conditions than those from other countries.

We have concentrated on a comparatively small number of varieties, and this is due to the fact that the orchardist has usually had in view both the keeping and export qualities of his fruit. Local demand is constant, but it is not great and will soon be utterly inadequate to consume the immense quantities of apples which South Africa can and will produce. Of the varieties given in the long list which follows, not more than a dozen are likely to be grown on a very extensive scale. The selection of those which shall be grown does not depend on what one wants to grow exactly, but on what one can grow. Certain localities are adapted to the production of certain varieties, and these are gradually being decided on and adopted.

Popular Varieties.—Mr. H. E. V. Pickstone, in a letter dated May 19th, 1924, states the following is a list of favourite varieties:—

Early.—Sharp's Early, William's Favourite.

Mid-season.—Jonathan, Cleopatra.

Late.—Delicious, Commerce, Versfeld, Rome Beauty, Ohenimuri, White Winter Pearmain and perhaps York Imperial.

Mr. D. A. English, Maritzburg, Natal, states that amongst the more prominent Natal growers, Mr. Dix, of Winterton, selects the following:—

Early.—Carrington.

Mid-season.—Cleopatra, Wainwright.

Late.—Rome Beauty, Horne, Versfeld, Reinette de Canada.

Mr. Scott of Xuka Drift, selects the following as his favourites:—

Rome Beauty.
White Winter Pearmain.
Ohenimuri.
Missouri Pippin.

Messrs. F. H. Hartley and Son, Transvaal (Magaliesburg) favour:—

Jonathan.
Ohenimuri.
Rome Beauty.

They say that Magaliesburg might be the home of the last named, so well does it thrive there.

The Wargundy Orchards, Orange Free State, favour:—

Jonathan.
Rome Beauty.
Ohenimuri.
Commerce.
Missouri Pippin.

South African Varieties.—The apples which are now sometimes classed under the above heading are doubtless descendants of the earlier introductions and comprise the following varieties:—

Hugo.
Koo.
Versfeld.
Wemmers Hoek.
Bokveld.
Cape Sweet, and
Cape Sour or Zoet Appel and Zeer Appel.

Of these the best known and most widely distributed are *Wemmers Hoek* in the Western and *Late Bloomer* in the Eastern Province of the Cape. These are claimed by many to be one and the same apple, but the Eastern growers contend theirs is a superior fruit. Mr. W. Gowie, of Grahamstown, says that both were grown from seed from imported apples which probably grew on the same tree originally, but that climatic conditions, soil and environment generally have caused a slight change for the better in the Eastern Province product. He remembers an old tree of that variety in the Botanic Gardens at Grahamstown in 1890. The fruit of each may be described under one heading as follows:—

Wemmers Hoek or Late Bloomer.—A healthy, vigorous grower in good soils and when properly pruned. Fruits are roundish and of dark red colour completely covered with a distinct bluish-white bloom. Quality second rate. Excellent bearer of good and regular crops, good keeper and may be sent all over the world. Late.

Hugo.—This is a seedling originated at French Hoek on the property of the gentleman whose name it bears. Tree is a vigorous grower, fairly upright. Fruit conical in shape, creamy yellow ground streaked and splashed with light red. Not a reliable bearer and not recommended for commercial planting.

Cape Sweet and Cape Sour.—May be described under one heading. The tree comes true from seed and attains a large size, in fact it is one of the largest trees we have. The fruit is large, slightly conical in shape; colour light greenish-yellow until quite ripe, when it becomes yellow, with red stripes and splashes. Good for cooking, but will not keep. Of little value for planting. Early.

Versfeld.—Is claimed as a South African variety by some. It is, however, so like Rymer or Red Cauldwell that little doubt exists as to its identity with that variety. Tree a fairly vigorous upright grower, almost blight-proof. Bears large to very large fruits slightly flattened in shape. Colour greenish-yellow almost covered with dull red, not first quality and may be termed a general purpose apple, but more suitable for cooking than dessert. Bears regularly and well, is a good keeper and a general favourite.

Bokveld.—A Colonial apple, well known in the Western Province of the Cape, fair quality. Mid-season.

Koo.—A well-known Cape variety, principally grown in Western Province. Tree is hardy, fruit somewhat conical, greenish-yellow with dull red blush where exposed to the sun. Not largely grown. March.

Imported Varieties of Apples.—Of varieties of apples imported in recent years, say since 1893, there are very large numbers. Those introduced by Mr. H. E. V. Pickstone are amongst the best and have remained favourites. In addition, very many were brought in by the Agricultural Departments of the different Provinces before Union in 1910, besides introductions by nurserymen and private individuals. Amongst these may be mentioned:—

Fameuse or Snow Apple.—Of Canadian origin, one of the best, but neglected in South Africa. The tree is a fair grower and good bearer of medium-sized fruit. Shape roundish-oblate, colour crimson splashes and stripes on a light yellow ground. Excellent for local trade. Ripens February.

Lane's Prince Albert.—An English apple of excellent quality for culinary purposes. Tree very strong grower of spreading habit, bears early and yields regular and heavy crops of large-sized fruit. Shape round, flattened at base, inclined to conical calyx end, ribbed and irregular. Colour green turning to yellowish when ripe, with red blush on side exposed to the sun. Stores well. Ripens. March and April.

Wealthy.—A favourite American variety, raised from seed by Mr. Peter Gideon, of Minnesota. There is a monumental tablet erected in his memory as the originator of the Wealthy apple. The fruit is medium to large in size, of rich vinous flavour, roundish shape, colour light yellow ground, carmine on sunny side.

For some reason unknown, neither of the above varieties has been propagated by our South African nurserymen, although each has been tested at one or other of the experimental orchards of the Union, and favourably reported on.

List of the most Popular Varieties of Apples with short Description, commonly stocked by Nurserymen in South Africa.

The letters D *and* C *denote varieties suitable for dessert and cooking.* G *represents a general purpose apple.*

Adams Pearmain (D).—Tree medium grower. Fruit of medium size, true Pearmain shape with reddish blush on side exposed to the sun, good bearer of excellent keeping fruit suitable for high veld. Ripens February.

Alfriston (C).—Tree medium grower, bearing fruit of the largest size, somewhat flattened in shape. Colour pale yellow when ripe, a good bearer suitable for local use only. Good for the high veld. Has sold on Ermelo market for 8*s.* per dozen apples. Ripens February.

Allsops Beauty (D).—Tree a free grower bearing fruit below medium in size, shape conical, yellow with red blush. One of the prettiest of all apples grown, good bearing and keeping qualities. High veld. Will export well. Ripens March.

American Gentleman (D).—Described in nursery catalogues as "very large, conical, dark red apple." December and January.

Allington Pippin (G).—Tree vigorous and good grower and bearer. Fruit of medium size, roundish shape, varying slightly to conical. Colour yellowish almost covered with dull red stripes. Good keeper, ripens late.

Ballarat Seedling (C).—An Australian apple of good repute at the Cape. Roundish conical in shape, colour yellow, with red cheek. Ripens March.

Ben Davis (G).—A popular variety in America, not widely grown in South Africa. Tree is a healthy, hardy and vigorous grower, bearing medium to large size fruit of conical shape sometimes a little irregular. Colour yellow, covered with red splashes and stripes. Good bearer. Ripens late and keeps a long time. Good seller, but not of first-class quality.

Black Ben Davis (G).—A seedling of Ben Davis. Tree rapid, vigorous grower bearing medium-sized fruit in shape roundish to conical. Colour is a more decided red than that of its parent and often becomes very dark. Good bearer of good quality fruit. Excellent keeper. Ripens late.

Blenheim Orange (D).—An old English variety which does not do too well in South Africa, thrives best in the south coastal districts. Tree medium grower bearing large, handsome, round, sometimes slightly flattened fruits of most excellent flavour. Colour deep yellow with red blush on side next to sun. Good keeper. Ripens March.

Boston Russet (D).—The same as Roxbury Russet, which name is

not used in South Africa. Tree a good grower and heavy bearer of the real russet colour fruit. Medium in size and of good keeping qualities, is not much grown here. Ripens March and later.

Cardinal.—Described by Carter, of Maritzburg, as an abundant bearer of really excellent fruit, colour yellow streaked red, flesh sprightly, transparent. Early.

Carrington (D).—Supposed to be the same as Lady Carrington and Lord Carrington. One of the earliest apples in cultivation. Tree medium grower, blight-proof, bearing heavily at an early age, which prevents its attaining a large size. Fruit on the small side, roundish to flattened, sometimes conical. Colour yellow almost covered with pink stripes and splashes. Will not keep, has been sold on local markets before Christmas.

Cellini (C).—An early cooking apple. Tree vigorous grower, bears large size roundish fruit. Colour yellow, covered largely with red streaks, good bearer of fruit, suitable for local markets only. Not extensively planted in South Africa. Ripens in January and February.

Christmas.—Also called New Year and American Lady in Natal. Is an early variety, as may be gathered from the name. Tree is a moderate grower and bears good crops of pretty dark red apples small to medium in size, round in shape and of good flavour. Often ripens a second crop of fruit. Of use for local markets only. Quite different from the true Lady apple, which is hardly known in South Africa.

Champion (G).—Grown principally in Natal. Very much like Rome Beauty and said to be equally as good. Regular and heavy bearer. Keeps well. March.

Cliff's Seedling (D).—One of Messrs. Pickstone's introductions which has done particularly well in the Eastern Province. Mr. Wallace, of Grahamstown, speaks very highly of it. The tree is an upright vigorous grower and perfectly blight-proof. The fruit is of good size and resembles the celebrated Ribston Pippin in colour and flavour. Pearmain shape, is a good keeper and traveller and a most desirable all-round apple. Ripens March.

Cleopatra (D).—Originated in Australia. Tree healthy, vigorous, fairly upright grower and good bearer of large, conical-shaped fruit. Colour light yellow, darker when ripe. Keeps well and is a good shipper. Subject to bitter pit. In certain areas, on good soil and in moist atmosphere, however, is free. When well grown, is an excellent apple. Ripens March.

Commerce (G).—Introduced from America by Messrs. Pickstone. Tree strong, vigorous grower and good bearer. Does well in the Orange Free State, where it is a favourite. Fruit large, roundish, inclined to be flattened. Colour medium dark red. Good keeper and traveller. Ripens March and later.

Cox's Orange Pippin (D).—One of the finest of all dessert apples and a general favourite. Unfortunately, does not thrive on high veld, but appreciates its surroundings at Elgin and also in the Long Kloof on the south coast, where it approaches perfection. Tree, moderate grower and fair bearer of medium-sized fruit. Colour golden, with red blush next sun. Exquisite flavour, crisp texture and a good keeper. Can be exported anywhere. Ripens March and later.

Delicious (D).—Introduced by the Transvaal Agricultural Department and D. A. English, of Maritzburg, on two separate occasions. The two strains are not identical, but both are good. Tree is a vigorous somewhat upright grower and heavy bearer of medium size round to conical-shaped fruit of good flavour. Colour light to darkish red, not unlike Jonathan. Gowie, of Grahamstown, propagates the strain introduced by the Department. Good keeping qualities, does well in most situations, but best on high veld. Suitable for export. March.

Duchess of Oldenburg (C).—Tree not a free grower, has the merit of producing an early cooking apple of fair quality, not a success in Transvaal and Orange Free State. Fruit large, flattened. Colour greenish-yellow with red blush on side next to the sun. Will not keep. January and February.

Early Harvest (D).—An American variety and favourite in that country and in England. On account of its colour is not so popular here. Tree fair grower and heavy bearer of pale yellow, roundish, conical-shaped fruit. Crisp and juicy and good flavour. Not a keeping apple. December.

Emperor Alexander (C).—A Russian variety not extensively planted in South Africa. Tree a vigorous grower and fair bearer of one of the largest apples in cultivation. Shape conical with broad base, colour greenish streaked with red. Keeps fairly well. Not an export variety. Ripens February and March.

Esopus Spitzenburg (G).—Commonly called Spitzenburg, an American variety. Tree not particularly good grower, upright and inclined to spread, long and slender growths. Moderate bearer. Fruit of medium size, conical in shape, and in colour striped reddish to dark red over a yellow ground. Flavour of the best. Is a good keeper in storage. Ripens late.

Etterby Beauty (D).—A Natal apple, seedling, medium size, shape conical, deep crimson colour with thick purple bloom. A showy apple and better than its parent Tulis. Ripe January and February.

Glengyle Red (G) *or Red Rome*.—Mr. Terry, Government Horticulturist, Potchefstroom, states this is a bud sport from Rome Beauty, originated in South Australia. The same bud sport also occurred at Vereeniging on an orchard of the Vereeniging Estates.

The apple appears to be a more regular and better bearer than its parent. Same shape as Rome Beauty, colour clear bright red without streaks and dots as in parent. March.

Golden Russet (G).—An old English variety, one of the best of the russets. Tree fairly good grower, attaining good size, rather upright growth. Fruit medium size, roundish, inclined to conical at times. To bear regular crops must be pruned with care annually. An excellent keeper and would export if required. Ripens late. April. Will hang till frost.

Gravenstein (G).—Of German origin, in good repute in the Western Province, little grown up country. Tree is a strong vigorous grower and heavy bearer of medium-sized apples of good quality and flavour. Shape is roundish, flattened and occasionally of unequal sides. Colour yellow splashed and striped with red. Ripens February.

Horne (G).—A favourite Natal variety, where it does well in the midlands and warmer sections. Is highly recommended by Mr. D. A. English. Size medium to large, shape roundish, flattened. Colour yellow shaded and striped with red. Tree a strong grower and heavy bearer. March.

Irish Peach (D).—A variety formerly grown to some extent in the Eastern Province of the Cape, but not extensively planted to-day. Tree fairly good and upright grower and perfectly blight-proof. Bears heavy crops of small to medium-sized fruit. Shape round, flattened, colour yellow almost covered with red stripes. Not a keeper nor an export apple. January.

Jonathan (D).—A favourite American variety same type as Spitzenburg, which it resembles somewhat. Tree not a vigorous grower, rarely attaining large size, branches of a drooping habit, twigs slender, leaves rather small. A good bearer. At one time very largely planted in South Africa, now somewhat out of favour. Fruit is of medium size, rarely large, of excellent flavour. Shape roundish to conical. Colour varies much with locality in South Africa, fruit grown on the high veld being often of such a dark red as to approach blackness. In the south it is lighter in colour and has more stripes. Splendid keeper. Ripens February to March.

King David (D).—An attractive red apple, sells on its appearance, good for local markets.

King of Tompkins County (G).—An American variety very widely planted over there both in Eastern and Western States and generally successful in South Africa. Tree is a vigorous grower of spreading habit. A good and regular bearer when it reaches the age of about eight years or over, prior to that a light cropper. Fruit is large, rounded, very slightly flattened. General appearance red to dark red. Good keeper, March and April.

Lord Wolseley (G).—An apple of New Zealand origin, introduced

by Messrs. Pickstone. Is a vigorous grower and makes a handsome full-topped tree. Crops well and regularly. Subject to mildew near the coast and in the mist belt. Fruit roundish, slightly conical specimens are frequent. Colour green to greenish-yellow. Good keeper. April.

London Pippin (G).—Also called Five Crown. Tree a good grower and bearer. The five crowns may often be traced at the calyx end, and thus the synonym. Fruit medium to large in size, flattened. Colour green to yellow with attractive pink cheek. More suitable for culinary purposes than for dessert. Keeps well and is a good export apple. Ripens March.

Lady's Finger (D).—A well-known and popular variety in Natal and parts of the Transvaal. Tree fair grower and heavy bearer of long conical-shaped fruit of medium size which has given it the name it bears. Colour light yellow, striped with lightish red. A pretty apple, crisp and good to eat. Known also as the Forbes apple, having been brought to Amsterdam by the late A. Forbes about 1895. Also as Sheepnose and Harrakop in the Cape midlands. Keeps fairly well, not an export variety. January and February.

Missouri Pippin (C).—An American variety supposed to have originated in the State whose name it bears. The tree is a wonderfully early bearer, sometimes giving fruit whilst still in the nursery. Not a strong grower and has likes and dislikes as to soil; in some parts of the high veld is not a success. A heavy cropper of large, handsome fruit of second-rate quality. Fruit is very slightly inclined to conical. Colour yellow almost covered with pink and red stripes, has the general appearance of a red apple in the Transvaal, but is of lighter colour at the Cape. Good keeper. Ripens March.

Monmouth Pippin (C).—Another American apple of the Rhode Island Greening type, but with more attractive appearance. Sometimes called Red Cheek Pippin. Tree is a good grower, more spreading and open than upright, bearing large-sized roundish fruit with russety appearance round the calyx, skin yellow when ripe, shaded with pink to reddish colour. A good cropper, keeper and shipper. Ripens March and later.

Mother (G).—Of American origin and same type as Jonathan and Spitzenburg. Tree medium grower and good bearer of large-sized fruit, roundish, slightly flattened in shape, skin green and yellow, largely covered with red streaks. Good keeper. Has not been long enough under observation in South Africa to make statement about shipping qualities. Ripens March.

Newtown Pippin (G).—One of the most widely grown of American apples and an especial favourite on the Pacific coast. Tree is an upright, free grower bearing good crops of medium to large-sized

fruit of somewhat flattened shape, colour green turning to yellow when ripe, with a reddish-brown cheek. Excellent keeper and shipper, makes first-class dried article. Unfortunately, does not succeed too well in South Africa and cannot be generally recommended here. Late.

Nickajack (C).—An American variety which does well on the high veld and occasionally in the Eastern Province. Tree is a very strong grower, upright and spreading. Fruit large, roundish, slightly flattened. Colour dull reddish often with white bloom, heavy bearer of good keeping, somewhat second quality fruit. Ripens late—April.

Northern Spy.—An American apple very extensively used in South Africa as a stock on which to graft other varieties. The tree is perfectly immune to the attacks of woolly aphis, both root and branch. It is a vigorous grower and late bloomer. It does not come into bearing until late, sometimes a tree of this variety may be ten years old before fruiting and for this reason it is not largely planted. The fruiting is as a rule heavy in alternate years. The fruit itself is of the best quality, of medium to large size, shape somewhat conical, flesh yellowish, juicy, crisp and of rich aromatic flavour. Colour clear yellow covered with reddish blush, slightly striped and mottled with thin bloom. Ripens March.

Ohenimuri or Munro's Favourite (D).—This apple comes from New Zealand and is one of our best and most widely grown varieties, introduced by Messrs. Pickstone about 1894. Succeeds in a wide range of soils and climates, but prefers coastal or high veld situations. The tree is a good grower of upright habit and very hardy. Bears good crops of fruit, medium to large and sometimes very large. Colour yellow with pretty pink blush on sunny side. Shape round, flattened. Colour depends to large extent on locality of growth, being deeper in the Orange Free State and the Transvaal. One of the best of keepers, also good for export. Ripens March and April.

Paragon (G).—An American apple not much grown here yet. Tree moderate grower rather spreading than upright. Skin green shaded to red, sometimes dark red. General appearance red. Good bearer, keeps well, late.

Peasgood Nonsuch (C).—One of the largest apples in cultivation, not extensively grown here. Tree moderate grower, inclined to spread. Fruit large to very large. Colour greenish-yellow covered with red stripes and splashes. Medium bearer, keeps well, but is not an export variety.

Prince Bismarck (C).—Another very large apple. On Northern Spy roots makes very poor growth, is better on common Dutch Sweet Apple. Spreading habit, fruit large to very large. General appearance dark red. Not a heavy bearer nor good keeper, not an export apple. Ripens March.

Red Astrachan (D).—An early dessert variety not as popular as formerly, but a good early apple. Tree is a vigorous grower and heavy bearer of medium-sized roundish red apples. Crisp, juicy and of good sub-acid flavour. January.

Reinette de Canada (C).—One of the oldest known varieties, cultivated the world over, principally for culinary purposes. Tree is of a spreading habit, cannot be called a first-class grower. Good bearer of yellow, russety fruit sometimes with brownish cheek and many dots. Medium to large size, flattened and occasionally of very irregular shape. Keeps well, can be exported. Ripens March and April.

Rhode Island Greening (C).—A favourite American sort. One of the best cooking apples we have, is inclined to drop its fruit if high winds are prevalent. Distributed over the whole of South Africa, does its best in the south-west areas. Tree healthy grower of spreading habit. Bears regular crops of large to very large roundish slightly flattened fruit. Colour green, becoming yellowish as it gets ripe. One of the best apples for evaporating. Keeps fairly well in cold storage. Hardly an export variety. Ripens March.

Ribston Pippin (D).—One of the old favourites in England, where it has been grown for many years and regarded as one of the very best apples for dessert purposes. Unfortunately, does not succeed in many sections of South Africa. Does best perhaps at Elgin and also on the south coast (Long Kloof). Tree not of large size, rather spreading habit. Fruit is roundish; conical. Colour deep yellow, striped and splashed with dull red. Excellent flavour, fair keeper, will export. Ripens February and March.

Rokewood (D) (Bullock's Seedling).—An importation from Australia, where it is a favourite on account of its good appearance and all-round good qualities. Tree is a vigorous grower and regular and heavy bearer of small to medium-sized fruit. Skin yellow, almost completely covered with deep red blush, has general appearance of a red apple. Shape roundish, slightly flattened. One of the very best keeping apples, can be kept in storage almost the year round. Very valuable export apple, does well on high veld. Ripens March and April.

Rome Beauty (G).—One of, if not the most popular apples in South Africa and widely distributed over the entire apple-growing districts. Does well almost anywhere. It is of American origin. Tree not a particularly strong grower, upright at first but opens as it gets older. Bears early and well. Twigs long and slender. Fruit is rounded, very slightly flattened, very occasionally conical. Skin greenish yellow nearly covered with red splashes and blush, many white dots. Size large to very large. An excellent keeper and good for export. Ripens March.

Senator (G).—An American apple of good quality not extensively grown here yet but promises well. Tree, rapid grower but does not attain large size. Habit, spreading. Bears well and regularly. Fruit medium to large: roundish, flattened. Skin green to yellow almost completely covered with red to dark red: greyish spots. Does best on high veld. Keeps fairly well. Ripens February and March.

Sharp's Early (D).—An introduction of Messrs. Pickstone's. Tree blight-proof and a vigorous grower; bears regular crops of medium-sized fruit, flattened in shape. Colour yellowish, covered with pink and red stripes, resembles Irish peach. One of the best early apples. Ripens December and January.

Springdale (G).—An introduction from Australia. Tree hardy, vigorous grower: a regular and heavy cropper; promises to be one of the leading market varieties; gives good results on high veld. Medium to large size; colour bright red. Late. (From English's catalogue.)

Statesman (G).—Another Australian apple. Tree an upright grower. Good bearer. Fruit bright golden; striped and shaded crimson. Will keep in good condition until October if stored. (From English's catalogue.)

Stayman's Winesap (G).—A seedling of the old Winesap variety; originated in America; not much planted here; only moderate grower; habit spreading: bears regularly and well. Fruit medium size, roundish, conical in shape. Colour greenish-yellow, partly covered with red. Not a very handsome fruit, but of excellent flavour and keeping qualities. Can be exported. Ripens April.

Sturmer Pippin (D).—One of the few of Messrs. Pickstone's introductions which has not done well here; now discarded by them; a favourite apple in Australia. Tree a vigorous grower with handsome appearance, bearing medium-sized, roundish fruits. Colour shaded from green to brown; dull, not attractive. A good keeper. March.

Syke House Russet (D).—One of the smallest and best of the Russet apples of English origin. Tree moderate grower, which has done well here. Regular bearer of small flattish fruit; entirely covered with russet. Excellent flavour. Keeps well and will export. Ripens March and April.

White Winter Pearmain (G).—Perhaps the oldest variety under cultivation to-day. Hogg, a writer of authority in England, states: "This is the oldest English apple on record and its cultivation in Norfolk can be traced back to the year 1200."

It is a favourite variety in South Africa. The tree is not a particularly vigorous grower; the trend of the branches is outwards and the bark has frequently a rough or scaly appearance which is

peculiar to the variety. The tree bears regularly and heavily. Fruit is a decided oblong conic; tapering to the calyx end. Occasional specimens may slightly vary, but the fact that by " Pearmain shape " the above description is meant is conclusive. The colour varies from green to yellow, according to the stage of ripeness, and a brownish-red blush often covers the apple. The colour depends on the area in which it is grown. A good keeper and export variety. April.

Wainwright (G).—Described by Messrs. Carter, of Maritzburg, as an almost blight-proof tree, bearing medium to large fruit. Yellowish-red in colour with crimson stripes on the sunny side. A Natal favourite. Ripens February to April.

Wright's Perfection (D).—Described by the same firm as " A dessert apple of the choicest quality, tree almost blight-proof; of dwarf, sturdy habit, being an early cropper."

William's Favourite (D).—An early apple introduced by Messrs. Pickstone from Australia. Good, hardy grower; does well on high veld; medium-sized. Ripens mid-December.

William Anderson (D).—Also brought over by same firm and described by them as: " A very pretty dessert apple; above medium size; good flavour; keeps well: tree blight-proof. Late."

Winesap (G).—An old and valued American sort. Tree is of vigorous habit, spreading rather than upright branches; healthy and hardy. Bears regular crops of medium-sized fruit. Colour, yellow, overspread with red to dark red; sometimes russety. Good flavour; an excellent keeper and ships well. March and April.

York Imperial (G).—Another of Messrs. Pickstone's introductions and one of the best. The tree is a strong, healthy and vigorous grower, bearing well and regularly when cross pollinated with Wemmers Hoek. The fruit is red to deep red, on yellow ground. General appearance dull red; size medium, shape flattened; sourish. A wonderful keeper and good export apple.

Yellow Bellefleur (G).—A favourite Californian variety, but little grown in South Africa. Some success has attended it on the high veld. Tree is a vigorous grower of spreading habit and bears, when not too heavily pruned, good crops of large-sized yellow conical-shaped fruit of excellent flavour and quality. Stores well and is an export variety. Late.

Crab Apples. Siberian.—A small to very small apple of beautiful appearance; not much grown here and only fit for jelly and some cooking purposes. Tree vigorous grower of spreading habit. Shape of fruit is roundish and very slightly flattened. Colour bright yellow striped with pink.

Hyslop.—Similar to the above in growth, fruiting as most crabs do in clusters. Larger size; same shape; colour bright clear red.

CHAPTER XIII

THE APRICOT

The apricot is a native of Asia. In Persia, Afghanistan and what are termed " The Hills " in India, apricot trees are still to be found in a wild state. A type of the same tree is to be found growing wild in Japan. The cultivated tree as we know it was amongst the early introductions, arriving, as so many other kinds of fruit trees did, in the days of the first Dutch settlement at the Cape. Since then it has spread over the whole of South Africa, including Rhodesia, and may be found in nearly every garden. The tree is a handsome one when well grown. The fruit also presents an inviting appearance and is in general demand. It is one of the most profitable fruits to grow. It may be sold locally, exported, dried, canned, made into jam, mebos, etc. There are thus at least six distinct avenues for the disposal of a crop, and each may be exceedingly profitable providing the business is approached in a proper manner. The early fruit commands high prices in the markets of our large towns. Apricots of good stamp are acceptable overseas. The canneries are willing to pay good prices for the best samples. The dried article is responsible for the use of hundreds of tons annually. Jam-makers will take small fruit providing it is sound, and this makes just as good jam as the larger sizes. There is that delectable Dutch product known as " Mebos," the making of which calls for and uses up many tons of choice apricots annually. In addition, the export of pulped apricots is a growing business. Californians claim that the apricot is especially and distinctly their special fruit, the fruit which grows better in their soils and climate than anywhere in the wide, wide world. As an old Californian apricot grower, the author is bound to say that this fruit does, especially in a few favoured valleys, reach as near perfection as possible in that State. But the highest prices ever realised in England for dried apricots were paid for South African grown fruit in competition with the whole world and South African canned apricots are quoted at figures and sold at prices equal to those realised for the Californian article, so that there can be really little to choose between the products of the two countries. A difference does exist in the type of fruit grown. South Africans do not go in for " Moorpark " variety (the best of all apricots) to the extent the Californian does;

it is a bit shy in bearing, but taking one variety against another, it may be safely stated that Royal and Blenheim apricots, which are our leading varieties, can be grown in South Africa, equal to the best the world produces. The tree is hardy and vigorous, and in certain parts of the Eastern Province of the Cape, in the vicinity of Cookhouse has produced crops of fruit from the second year of its growth. Further, as the trees get older they become even more prolific. The fruit is not only good, but the trees are regular bearers and the fruit is eagerly sought after to supply the needs of the local canneries.

WELL-GROWN APRICOT TREE IN ORCHARDS OF HARTLEY BROS., MAGALIESBURG, TRANSVAAL.

As is usual in South Africa with all kinds of fruit trees, there are many seedling apricot trees, and the size they attain is really remarkable. Possibly the largest the author has seen in South Africa are in the Cape Midlands, near Graaf Reinet, where in a Karroo silt soil of unknown depth and plenty of moisture available the trees have more the size and appearance of oaks than apricots. Trunks of over 18 inches in diameter are to be seen and the spread of the branches is correspondingly wide. These seedling trees, untouched by a pruning knife and left to their own devices, have offered mute evidence for years past as to the suitability of their environment for the extended culture of the fruit. It has at last been recognised that here and in a few similarly situated localities further down the valley there exists one of the most promising openings for the development of the apricot industry in the whole sub-continent, and it is becoming more and more apparent that the South African apricot product will become a factor in the world's markets. Probably the tree is less troubled by enemies in the way of insects, pests and plant diseases than most others. Gum disease is sometimes found, also shot hole fungus, here and there. Sun-scald may damage the tree, but if this is the case it is the fault of the grower and not of the tree. A well-pruned tree does not suffer from sun-

scald. Occasionally a tree will suddenly die without any warning; the leaves wilt and in a week it is all over. This usually is traceable to sour sap caused by a more than desirable abundance of water round the roots. The fruit may be attacked, if allowed to ripen on the tree, by beetles in some parts of the country, but on the whole the apricot may be regarded as a tree which, if properly looked after, will give its owner less trouble than most others. In the past, Wellington, in the Western Province of the Cape, was always regarded as pre-eminent in the growing of first-class apricots. So popular has the growth of that fruit become there that many acres of trees were planted on soil which was unsuitable. The main idea was to get land at or near Wellington. The fact that all land there was not suitable for the apricot was lost sight of. Yet this district remains one of the largest producers in the Union. It is a question whether a large area in the Western Province is not equally as good as Wellington for this fruit.

One primary consideration in selecting a site for an apricot orchard is that drainage shall be good; another that no frosts shall occur to cut the blossoms, or later ones to destroy the fruit. Where sufficient drainage is absent, the soil is liable to get water-logged and the result is the appearance of gum disease and possible loss of trees. Where frosts occur there is the annual danger of the loss of part or possibly the whole of the crop. The most damaging of all are the late frosts which may come in September and October, when the fruit is a little less than the size of a walnut. These do not cause the fruit to drop at once, but if on examination the kernels are found to have become brown in colour, it is certain that much damage has been done. It is a generally accepted idea that the apricot thrives best when it is not too far removed from the sea. There appears to be some peculiar affinity between the tree and the sea. Years ago, in California, the author had an apricot orchard within sight of San Francisco Bay. The daily winds came from the north, commencing about noon through the spring and summer and blowing south, yet the young growths on all the trees insisted and persisted in turning their tips towards the ocean, due north, against the wind. And so we find in South Africa that our best apricots are grown within a measurable distance of the coast. Whilst many fine trees are to be found up-country in the Transvaal and Orange Free State, there are very few indeed—no matter of what variety—which bear fruit equal to that produced nearer the sea. There are many good apricot orchards in the Transvaal; their product is the earliest in South Africa, and finds its way to the large local markets, where, because they are the first apricots of the season, good prices are realised. Later on larger fruit from the Cape holds the field.

As stated, the seedling apricot grows to be a very fine tree in the deep silt soils of the Karroo. It does not, however, succeed to the same extent on other stocks in the same soil, when available moisture is likely to be brackish. Soils and stocks must therefore be discussed together. Given the deep rich silts with a supply of sweet pure water, the use of either peach, plum, almond or peach almond roots may be justified. Nursery practice has decided that the latter is one of the most reliable stocks to use in the Karroo soils and on it the apricot is frequently budded. This stock is one of the hardiest, and can if compelled put up with considerable brack, which does not detrimentally affect the fruit. Almond stock is also hardy, but not much used for the apricot. It is stated that the use of the almond as a stock results in the production of that most objectionable type of apricot, one with stringy flesh. Plum roots for apricots are not a success on Karroo soils. The wonder is that more use is not made of the apricot as a stock there. It is a very rapid grower and always induces the production of fine fruit. The same variety of peach, let us say, grafted on a peach and on an apricot stock standing side by side, would bear better fruit on the latter than on the former. The one objection appears to be that the union between the stock and the tree is weaker when apricot stock is used, and in high winds the tree is likely to blow off its roots entirely, broken at the graft. Given a Karroo soil, free from brack, then the peach as a stock for the apricot may be safely used. There is a stronger union, a hardier root, and very little chance of the tree blowing off at the graft.

It is the peach root which is mostly used as a root for all kinds of stone fruit throughout South Africa. Of all those used as stocks, that known as St. Helena or Transvaal Yellow is the hardiest and best. In the Western Province of the Cape, in Natal and the Transvaal, this peach is always in demand for use as a stock. It thrives better in poor soils than any other, it resists alike both drought and flood. In the rich deep red loams of the Transvaal and Natal it is equally at home and appreciates its surroundings, whilst on wind-swept gravelly hill slopes the author has seen it battling valiantly for a living. It will be seen, therefore, that the soils on which the apricot does best are largely dependent on the type of stock on which the tree is worked. Possibly nine-tenths of the apricot trees in South Africa are budded on peach stocks.

The plum also has been mentioned as a stock for the apricot, but its use is not resorted to excepting very occasionally, when it may be considered advisable on account of having to plant on a heavier type of land containing, or subject to occasional visitations of, considerable moisture. It stands " wet feet " better than other stocks. It also is stated against the use of the plum as a stock that it has a

slight dwarfing effect on all trees budded on it. A few years back, nurserymen worked a few apricots annually on plum stocks, but the practice has fallen into disuse. A choice of soils and stocks, then, for the growth of the apricot, works out something like the following:—

1. On deep rich Karroo silt, either *Peach almond*, or apricot, both stand brack better than the peach stock.
2. On the deep red loams so common up country in the Transvaal, Orange Free State and Natal, and also in the Eastern Province of the Cape, the Transvaal Yellow and next, any common seedling peach.
3. On shallow, gravelly soils, the peach.
4. On darker soils, subject to moisture, the plum or yellow peach.

Soils which are easy to work, such as those first mentioned, are not only more suitable as far as the actual needs of the tree and fruit are concerned, but they are more desirable, because it is not necessary to start ploughing or discing or work of any kind at a particular moment, as is the case with soils of a more refractory nature. Clay and turf soils, if taken at the right time, may be handled in a satisfactory manner, but if that period is allowed to slip by, it will sometimes happen that no further opportunity of getting the land into shape will occur for some time. An orchard the surface soil of which cannot be reduced to a fine tilth, but has to remain in the clod stage owing to failure to seize the exact moment for working it, is likely to be an eyesore. In addition, loss of moisture of a serious nature may occur. Throughout the whole of South Africa the apricot should be planted during the dormant season. Usually the best month is July, though in the warmer parts of the country June is sometimes preferred. In former years, it was customary to plant nearly all fruit trees during the summer months. This was especially the case in those districts where summer rainfalls occurred, nurserymen kept trees in tins ready to send anywhere. The roots were often pot-bound, and as a consequence the trees frequently did not make good. This practice is now nearly at an end, fortunately for fruit growers.

Considering that the apricot grows to be such a fine tree, it is necessary that it should have plenty of room to grow in, and it is a mistake to plant them at a lesser distance than 24 feet apart. They are better planted on the square system than any other. The methods set out in the chapter on planting should be carefully observed. As many of the strongest roots as possible should be retained. It is better to plant a tree of any kind of stone fruit of a year old than one of two years, but more especially in the case of the

apricot. The wood of this tree is rather brittle and when one gets a tree of one year's growth and starts the branches himself they can be made to grow at the desired spots—not all starting from the same point. In purchasing a two-year old tree from a nursery, the formation of the future head of the tree has been commenced by the nurseryman and his ideas may not coincide with your own.

Pruning at planting time is much the same with the apricot as with other young trees. After planting, all the trees must be cut down to a single stem about 20 inches in height, and that stem forms the trunk of the future tree. An apricot tree, well pruned and cared for, should last for forty years or more, and so it is worth while to spend a little time and thought as to how best to build up a tree which shall be capable of bearing large crops of fruit annually with the least possibility of loss of branches from high winds or from breaking down from the weight of fruit. In any case, the apricot is a rank grower, putting out a vigorous growth of young branches every year; some are in the right place, some are not—the former may remain, the latter come away. The pruning of an apricot tree during the first three years of its life sets the foundation on which, later, the bearing formation of the tree is carried. These are the branches which are allowed to remain and they should be selected with judgment. The main idea when pruning is to carry in the mind's eye the shape which it is desired the future tree shall assume. The tendency to overgrow, which is pretty general in the apricot in South Africa, should be checked. There are but a few varieties which do not grow vigorously, and in dealing with these the grower must act with discrimination. The custom has latterly largely prevailed of hollowing out the centres of all stone fruit trees and allowing only the outside branches to remain. This is unnatural, and, although perhaps desirable in some instances, is most certainly not so with the apricot, as it leads to small crops of fruit instead of larger ones. The outlets for large fruits are the export trade and the canneries; the former is a comparatively small one and it does not pay to grow large apricots only. Large crops are wanted as well. The hollow or basket formation for the apricot tree is not wanted. On the other hand, it is not desirable to have the centre of the tree crowded with branches. Plenty of room for the entrance of light and air is required, and the removal of all branches which cross or interfere with others. Always allow the one to remain which is growing in the right or natural direction. We will suppose that a young apricot tree has been started to form three main branches, which will be allowed to remain for the first year. These have been spaced so as to allow a few inches between the base of each and selected to point perhaps, north, south and east, or something like that. There will come during the growing season many

other branches and these should be removed soon after appearing and the three main branches should be pinched back with the finger and thumb if they grow too rapidly. The end of the season will then find the tree with three long branches, each with one or two bunches of laterals. The first year's pruning consists in cutting these back to about 16 inches. This in most cases means cutting the branch off below the little bunch of laterals, which is as it should be.

During the second year's growth, many more branches will want to grow than there is any need for. The superfluous ones must be ruthlessly removed, as also must all having a tendency to grow downwards; the trend of the branches should be upwards and outwards. If the main branches seem to be running away they may be pinched back as before. About six should be allowed to remain at the end of the season, and these should be cut back to, say, 20 inches in length. The third year is another of rampant growth and calls for the drastic removal of many unwanted branches. A few fruit spurs may be thrown out here and there, and the rest remain, as a little fruit may be expected the following season. In cutting back the main limbs one may leave up to 20 to 24 inches, but if this brings the cut into the bulge of laterals then cut either above or below these.

From this time onwards each year is liable to see some very slight diminution of wood growth, caused by the new drain on the resources of the tree by the production of fruit. Fairly vigorous growth is usually kept up until the eighth year, but after that it gradually diminishes and the work of pruning is not as exacting. Still the knife is the life of the apricot, as it is of the peach tree, and an annual winter pruning is necessary. In addition to this it has been found of benefit to resort to summer pruning in some cases in older trees, though not quite in the same way as in their younger days. Originally, the custom came into use in California as a means of making the Moorpark apricot bear regular annual crops; at any rate, it was tried with that object in view, and found to answer in a few instances. The practice is to be commended where rampant growth continues to occur after the trees have arrived at years of discretion, as well as for the purpose of inducing good bearing habits.

Summer pruning may not necessarily mean the actual cutting off of lots of young shoots, though it very often does, but there are many occasions when pinching back of the ends of the growth with the finger and thumb is all that is needed. Summer pruning, with the idea of inculcating the fruit-bearing habit, should be done in February; the flow of sap has considerably diminished by then and is insufficient to renew growth, but yet strong enough to benefit the fruiting spurs and laterals.

Thinning.—It takes a brave man to thin fruit in South Africa, especially in the Transvaal. There are so many excuses for not doing so. Yet the practice is steadily gaining ground and is a justifiable one from every point of view. If all the fruit on a vigorous growing tree is allowed to remain, there is an undue strain on the tree; the fruit which remains after the operation of thinning attains better size, colour and shape; it is worth more money because of this; if a tree is allowed to bear all it will, without thinning, the result will be crops every other year, instead of regular annual crops.

It is certain that more money is obtained from trees which have been thinned than from others of the same age and the same original crop which have not, so if by thinning one gets more money, more and regular crops, and the tree is in better health and vigour, thinning certainly pays. Probably one-half of the whole crop may be pulled off, and this should be done after the last chance of late frosts has gone by and whilst the pits of the fruit are still in the soft stage. This means when it is about the size of a small walnut. If thinning is properly and systematically done, no difficulty is experienced in producing apricots which will pass the fruit inspector as fit for export as far as size goes.

It is possible that occasions may arise where, owing to class of soil or variety of tree, the production of canning fruit is not as profitable as the growing of large quantities of smaller fruit. Even in such conditions thinning pays, though it need not be as drastic as when very fine fruit is required, and it is generally considered sufficient to "break the bunches," perhaps pulling off one-third of the fruit which is found growing in bunches and allowing the balance to remain. Years ago in California apricots for canning purposes were supposed to go eight to the pound, but now much smaller ones are canned, and in South Africa very few are canned which go less than twelve to the pound.

Like other operations in connection with fruit growing, those of pruning and thinning are frequently matters of dispute between recognised authorities. All agree as to the wisdom of thinning, but the extent to which the practice should be carried and the methods to be observed are often at variance. Here are the opinions of two of the leading apricot growers of California, as published in the *Proceedings of the State Board of Horticulture* some twenty years ago, and it may be added a similar divergence of opinion exists to-day:—

Opinion of Mr. D. C. Vestal (San Jose).—"Do not thin much. Where there are large clusters and the fruit is crowded, remove the smaller specimens and allow the larger ones to develop, but where there is ample room for your fruit to grow without crowding leave it alone."

Opinion of Mr. J. H. Flickinger (*San Jose*).—"Thin and thin vigorously. Of course a great deal of judgment must be used here as elsewhere in orchard work. We have to take account of the seasons, the bearing qualities of the tree, the quantity of fruit which has set on it and the variety of the tree. Some apricots, like the Blenheim, will mature more fruit than others and require a more vigorous thinning to secure the best results, but taking the average apricot tree in a condition to carry through and mature its entire load of fruit and when fruit sets thick, seventy-five per cent. should be removed."

It may be remarked that Mr. Flickinger had a cannery. It is still carried on in his name.

The stage of ripeness at which apricots should be picked depends upon the requirements of the market to which they are to be sent and the method of getting them there. If for export, they must be well coloured, but not ripe. If for the cannery the same rule must be observed and no soft fruit must on any account be included. If for drying, then the fruit must be ripe, but not soft. The jam manufacturer likes his fruit in the same condition, but though he may be willing to accept small apricots, he will certainly insist on getting them sound. The idea that anything will do for jam is a mistaken one and the sooner it is disposed of the better.

Hand picking of the apricot should be practised at all times. Shaking the tree in order that the fruit may fall to the ground is wrong. Fallen fruit is always bruised, and when the apricots are dried, each bruise shows up as a bl_ck mark, thus reducing the value of the product. Bruised fruit for the cannery or for export is out of the question; none but the best is wanted in either case. Bruised fruit sent to the jam manufacturers is liable to be bad before it is used or made into pulp, then either the jam or the pulp will prove to be a very second rate article.

Step-ladders specially made for picking are needed to gather the apricots from the higher branches. The best type are made to a pattern brought by the author from California thirty years ago and remain to-day the best and most suitable for the purpose. They are something like an ordinary step-ladder, with a broader base, tapering to the top with a third leg or support which may be placed inside the branches of the tree and brings the picker into close contact with the fruit.

Apricots not for export should be picked in proper tin buckets made for the purpose and placed in them rapidly yet carefully and the buckets emptied into lug boxes, which should be hauled to the pack-house without delay. To allow lots of boxes to remain piled up, possibly in the sun, is bad management, so when stacks of boxes are made, they should be placed in the shade of a tree. Apricots

for export should be treated in the manner prescribed in the chapter dealing with fruit export.

There are many varieties of this fruit in South Africa. Some are good and are amongst the recognised best varieties all over the world where apricots are grown. Amongst these the following take first place:—

Moorpark.—This is an old English variety and may be found on many a wall with a southern aspect in that country. For size, quality, richness of flavour and beauty of appearance it is unequalled. Unfortunately, its record as a bearer is a poor one. Many trees bear satisfactorily from the fourth to the eighth year inclusive. After that the Moorpark must be described as a shy bearer and on that account is not extensively planted in South Africa. It yields the best fruit for drying and is also the best canning apricot. The fruit is of the largest size, fairly round, and good specimens should measure $2\frac{1}{2}$ inches in diameter. Occasionally one side of the fruit will ripen considerably before the other, the dividing line being the suture which runs from stem to apex of the fruit. Colour is deep orange-red or brownish-red with numerous spots. Flesh firm, sweet and luscious, parting freely from the stone. Ripens about January, depending on the district in which it is grown.

Blenheim is also an English variety of excellent quality which does well over the whole of South Africa. Is not quite as large as Moorpark, but still a good-sized fruit and well distributed over the tree, which is a vigorous grower and a good and regular bearer. The fruit is lighter in colour than the Moorpark, sometimes approaching lemon colour. Shape is slightly oval with deep yellow flesh, juicy and full flavoured. Freestone. Is an excellent drying variety, also good for canning and export.

Royal.—This is one of the favourite apricots in South Africa. It is of French origin and has done well wherever planted here. The tree is a strong and sometimes an ungainly grower and very vigorous. It is one of the most certain bearers. The fruit is good-sized, especially when properly thinned, not quite as large as the Moorpark and rounder than the Blenheim. The colour is yellow, approaching orange and the fruit often has a red blush on the side next to the sun. Flesh dark yellow, firm and juicy. Freestone. Suitable for export, canning, and an excellent drying apricot. Ripens a little earlier than Blenheim, but much depends on locality. End November to December.

Tilton.—This is purely a Californian variety, having been raised from seed in Kings County in that State. It was introduced into South Africa by Messrs. Pickstone some years back. It has a very long blossoming season and on that account the tree is considered

amongst the most reliable bearers. Should frosts harm some of the blossoms, there are more to follow. The tree is a strong grower. Fruit large and handsome; good colour and flavour. Freestone. Ripens later than Blenheim in most districts. Suitable for export, canning and drying.

There are many other varieties of apricots propagated in South Africa—some of these are descendants of the early introductions and these are mostly classed as Early Cape, Cape, Old Cape. Others are South African seedlings, as Colenbrander. It is not proposed to describe every one of these. Indeed there are one or two which the author has not seen, although nearly all have been under test at one or other of the experimental orchards of the Union.

Early and Late Varieties.—Early Cape. Is well known in the Western Province of the Cape, whence it has spread over the fruit-growing districts of the Union. Messrs. Pickstone say " it needs no recommendation," and being an early variety, it always fetches a good price.

Alpha. Perhaps the earliest of all apricots in South Africa. Like most fruit which comes very early, the Alpha, and practically all in this class, are not of the very choicest quality; for instance, they will not compare in size and flavour with Royal, Blenheim and other later varieties. Their merit lies in the fact that because they are early they are profitable.

Colenbrander. This is a Natal seedling, and one of the best of the early kinds. Has been tried very little outside Natal, where it is a favourite. Is described as a full-flavoured, highly-coloured fruit, with regular bearing qualities.

Early Newcastle. The right name for this is Newcastle. The " Early " has been tacked on here. It was for a long time the earliest on the market—hence the name " Early." It is a good quality fruit, and a standard Californian variety, having its origin in Newcastle, California. The tree is a quick grower and regular bearer. Fruit medium size, nearly round, reddish cheek on the sunny side. Freestone. Good for local markets.

Will's Early. This also belongs to the " Early " group and is classed by some as the earliest of all. It is not, however, as early as Alpha.

Second Earlies.—Oullin's Early, Pineapple, Victoria. Because they are but second earliest, these are planted only in limited numbers. Probably the best of them is Oullin's Early which under test at Potchefstroom Experimental Orchard proved most successful both as a grower and a cropper.

Mid-Season.—Royal, Blenheim, Old Cape, Hemskirk, Breda. Of these the first two have been described and the Old Cape is well known.

It has been tested for many years in South Africa and proved a good and useful variety in many districts. It is not, however, largely planted outside the Western Province of the Cape. It makes an excellent dried article, and is in demand for that purpose.

Breda has a good reputation, and is an excellent cropper. It is not, however, largely planted.

Late Varieties.—Moorpark, Tilton.

CHAPTER XIV

THE CHERRY

The history of the cherry in South Africa does not go as far back as that of most other fruits.

Even if cherries were introduced in the early days of the Dutch occupation, it is highly probable that the trees died. It may have been that they were discarded as useless, because it cannot be claimed that the cherry is a success in any part of the Western Province of the Cape in the immediate vicinity of Cape Town, to which area all the early introductions were brought. Why, then, waste time on a tree which did not bear fruit?

The cherry is indigenous to Europe and Asia; Japan is celebrated for its cherries, and their blossoming time there finds an excuse for many delightful celebrations. Wild cherries are to be found in the woods in England and other countries of Northern Europe. This fruit is small and sour, but the trees are sometimes useful as stocks on which to work other and better varieties. The trees are at their best in a temperate climate. Kent, the so-called "Garden of England," is famous for its cherries, and the climate there, with its constant moisture, seems to suit the tree to perfection.

It may be said to be out of its range in the Cape Peninsula. It is difficult to find any literature of South African origin in which mention is made of this fruit. The late Professor MacOwan, botanist, and Eustace Pillans, horticulturist, of Cape Town, published, in 1896, a "Manual of Practical Orchard Work at the Cape," but the cherry is not noticed at all. As a fact, in those days the cherry was quite an unusual fruit to see in Cape Town. The author first saw them there worn as button-holes and they were obtainable, in very small quantities, at 1*d.* each in 1898. It would appear that the immediate neighbourhood of Johannesburg saw the first developments of cherry-growing in South Africa. Amongst the numbers of men who had become wealthy from association with the gold mines, there were many who possessed an intense love for horticulture in all its branches, and they spared no expense in procuring trees, plants and shrubs from all parts of the world in order to make their gardens and surroundings beautiful. There was no hindrance to the entry of any variety of tree from any quarter, and it is on that account that one may find such a large and diversified

collection of exotic plants, fruit and ornamental trees scattered round the lovely suburbs of Johannesburg.

Mr. J. H. Rainier, an old inhabitant of that city, writes as follows:—

"When I had my first cherry trees planted in July, 1898, I knew nothing about fruit growing, and the trees were planted only about 11 feet apart, and I had to cut away a lot of wood to keep them from growing into one another. I refer to the trees planted in July, 1898, viz., Monstreuse de Mezel, Emperor Francis, Governor Wood. The Monstreuse de Mezel I considered the best all-round cherry, of which I sent you some fruit about 1904, and a photo of same appeared in the 'Agricultural Journal.' The tree has borne splendidly every year. Although some of the tree has been cut away, I reckoned for the 1922 season the crop must have approximated 200 lb. weight per tree. The fruit is very large, heart shaped, yellow and red, and ripens just before mid-November. The fruit carries well, as I frequently sent parcels by agricultural post to friends in the Cape. It is therefore a good packing cherry.

"Emperor Francis is next on the list. It ripens a week later, about November the 20th. This cherry is very large, round and dark red. It is not so delicate in flavour as Monstreuse de Mezel; it is an excellent packer and a tremendous bearer.

"Governor Wood I would not recommend for market purposes as it is too delicate to carry. It comes into bearing about October the 1st and is a luscious large fruit, and nice to have in orchard. It is light red and yellow and an abundant bearer.

"Bedford Prolific I would have put down as the third best. This tree I put in about 1908 and it has done very well. It is a prolific bearer, but not in clusters like Monstreuse and Francis. The fruit is reddish-black, and kidney-shaped, and a fair packer. Ripens about October the 25th.

"Early Rivers comes next. It is very much on a par with Bedford Prolific. Same coloured fruit but oblong. It is certainly a lovely cherry, good packer, and quite a large fruit. Ripens November 10th.

"Amber Heart is a very sweet delicious cherry and prolific bearer. The colour yellow and red, heart-shaped, and should pack well.

"I have also the Elton, which stands right up against two *Macrocarpa* hedges, and conditions therefore are very unfavourable. It, however, had a fine crop last season, a delicious conical-shaped cherry, yellow with a little red, of fair size, and should pack well. It bears singly and not in clusters. Ripens about November 15th.

"Bigarreau Early Red is not an early cherry, as it ripens about November 20th and I should therefore term it late. It is a fine

large red cherry, good bearer and packer, but a bit woody. It is a question whether I should not put it before Bedford Prolific and Early Rivers and Amber Heart. I think I should have done so.

YOUNG "BEDFORD PROLIFIC" CHERRY TREE AT SCHOOL OF AGRICULTURE, POTCHEFSTROOM.

[*Photo by H. B. Terry.*

"I have other kinds of cherries, but I cannot recommend them for the market, viz., Guigne d'Annanay, which ripens on October 7th, one of the earliest. The fruit is very small; I also have Frogmore, which is a most deliciously sweet cherry, very delicate, with a flavour of its own, but the birds play havoc with the fruit, owing to

its being so luscious. All these I purchased from W. and C. Gowie, of Grahamstown.

" I have two other kinds of cherries, Belle de Montreuil and Belle de Magnifique, but they have turned out to be more of a cooking cherry, but I have kept them as they ripen up late and the rain does not crack them.

" Generally speaking, my soil is very shallow. Eighteen inches is its best depth, with Hospital Hill shale underlying. I, however, keep my ground cultivated, and water my cherry trees in the early spring as soon as the blossoms start. My trees are too close together; if they had proper space between them they might not want so much water. My trees have kept healthy, with the exception of Emperor Francis (planted July, 1898), which started gumming last year and two fair-sized branches died off and I had to saw them off. Otherwise the trees all look healthy and have always been free from scale. Last year was the first occasion when I sprayed some of the cherry trees with ' Harbas ' during the winter, as I thought it would do them good. I have done a little pruning, but I think it a mistake, as cherry trees do not seem to like to be pruned. There are only two drawbacks to the question of profit; the first is continuous rain of some twenty-four hours when the fruit is about to ripen or is ripe. This causes it to crack badly and it is consequently not marketable. The remedy is to plant an equal number of each of the trees I have mentioned, and if the rain catches the one class, the grower would be able to make good with the later one, and if the rain caught the later bearers he would have some return from his earlier varieties.

" The second pest is the bird question, especially the sparrow. Up to a few years ago I had no trouble with the sparrows and they seem to have acquired an appetite for cherries and simply slaughter the fruit all day long. The muisvogels and yellow tails are also a nuisance, but they do not hang about the trees all day long as the sparrows do. The remedy is to have the trees wired with bird cage wire. I tried mosquito netting with the smaller trees, but the young shoots suffered by the netting pressing on them.

" I consider this high altitude very suitable for cherry growing, and there is a line between this and Pretoria beyond which cherries would not answer. I have not had a blank all these years, as the trees have always blossomed beautifully and fruited well, some years a more bountiful crop than others, but always quite satisfactory, and when not too abundant, the fruit has been larger.

" Monstreuse de Mezel, Emperor Francis and Red Bigarreau were readily saleable at 2*s*. per lb. last season to the Greek shops, where they likely retailed them at 5*s*. per lb.

" I would place the trees as follows in order of merit: Monstreuse de Mezel, Emperor Francis, Early Red Bigarreau, Bedford Prolific,

Amber Heart, Early Rivers and Elton (bracketed), Governor Wood for domestic purposes."

In a later communication Mr. Rainier adds: "The first cherry I ever tasted was from a small tree grown in a garden at Ceres. I understand they came from Koude Bokkeveld."

There are a number of growers in and around Johannesburg who have trees equal in size to any trees of a similar age to be found anywhere and bearing fruit which is simply unsurpassed in quality and flavour. Our cherry growers have nothing to be ashamed of in quality either of their trees or of their product. Naturally the trees bear larger-sized fruit when they are young than they do in after life, but even from some of the oldest of existing trees one may find fruit measuring close on an inch in diameter.

The cherry is grown all too sparsely in South Africa. There are certainly a very large number of districts where the tree will not thrive, others where it will grow and not bear fruit, but once let soil, climate and environment generally be such as the cherry appreciates, the tree will demonstrate, by its vigorous growth and the fruit it bears, its appreciation of the situation.

Briefly, the Transvaal and Orange Free State high veld at altitudes ranging from 5000 feet upwards are where the best cherry trees are to be found. Recently at Beaufort West in the Cape at an altitude of 3000 feet some attempt has been made at cherry growing, and not apparently unsuccessfully. Success has also attended efforts made to grow cherries at Ceres. The venture is, however, of too recent a nature to speak with any degree of authority on the subject. The climatic conditions at the altitudes named are very different from those in the bulk of the Cape Province. Snow in winter, a fairly good rainfall, averaging about 30 inches and this distributed in the summer months, provide a climate more nearly resembling that found in the temperate zone than can be experienced anywhere else in South Africa. In California hundreds of acres of cherry trees are grown not far from San Francisco Bay, at scarcely any altitude above sea level. These areas have proved amongst the most successful in the State. Here in South Africa we have to climb up high to get a similar climate—which goes to show, when speaking of certain fruits doing well at certain altitudes, that it is really not the altitude at all but the climate which is found there which makes for the satisfactory growth of these fruits.

The first cherry orchard of commercial standing to be set in South Africa was planted by that pioneer of fruit-growing in this country, Mr. H. E. V. Pickstone, on his farm "Platkop" in the Orange Free State, at about 5300 feet altitude, near Clocolan, and within sight of the snow-clad Maluti mountains of Basutoland about 1905. It was known that the tree flourished at Ficksburg, not far away.

On the Wargundy Estate, near Westminster, cherries were also successfully grown. The bulk of this fruit produced in South Africa comes from the Orange Free State, but the eastern high veld of the Transvaal, from Johannesburg to Belfast and southwards, could produce large quantities equally well. There are spots in Natal, Griqualand East and the Cape which will later on be found suitable for growing this fruit.

It is a generally acknowledged fact that the cherry does best on deep, rich and fairly light soil. Such soils as are termed Karroo soils, composed largely of river silt, would be ideal for the cherry if only they existed in a suitable climate. The hot, dry air of the Karroo, excellent as it may be for some fruits and vines, is just what a cherry does not care for. However, when one examines the soils in which this tree seems to delight in and around Johannesburg, the conclusion is forced upon us that the cherry tree either is not as particular as to soils in South Africa as in other parts of the world, or that it has developed a decided partiality for rock. To the uninitiated, it seems ridiculous that what we call " Hospital Hill shale " should grow good cherry trees, yet such is the case.

It must not be understood that these shales are recommended generally as sites for cherry orchards, although the shale suits the cherry. There are soils which are soils and not rock, which are far better. An ordinary light loam of good depth is a suitable home for the cherry tree, and there are plenty such in both the Orange Free State and the Transvaal. The roots of the trees are intolerant of any substratum of clay. The presence of " pot clay " or " Oude Klip " is fatal. What the tree likes is plenty of room for its roots to forage at ease, and moisture sufficient to provide means of assimilating sufficient nourishment. If the moisture is not in the ground it must be put there, for without it the tree cannot grow. Drainage is also important, because though the tree must have water enough, it does not like to have its roots standing in it and so a subsoil which might be either sandy and pebbly or gravelly would be by no means an unsuitable one. Fortunately, during the growing season of the cherry we have our rainfall and provided the soil is fairly retentive of moisture and of sufficient depth, there is, with the judicious use of the cultivator, every prospect of getting through the year without resort to irrigation. The ordinary red loams which are such a feature of Transvaal and Free State soils may be said, generally speaking, to be also suitable for the cherry; the one proviso is that no clay be present. When we come to the red and black turf ground, it can be safely stated that the cherry should not be planted, and where water stands within 8 feet of the surface, the same remark applies.

Practically all the stocks used in South Africa for the propagation

of this fruit are imported from Europe, principally France. They are seedlings of the Mazzard or the Mahaleb varieties, usually the latter. It is useless to bud the cherry, as we do any other kind of stone fruit, on the peach, the bud may take and grow, perhaps for a year, but it invariably dies an untimely death. Such being the case, it looks as if we should have to continue to get our requirements from France for some considerable time. It should be possible to grow our own stocks, but the sale of the young trees is disappointing, and the demand not large. They are a little difficult to grow, perhaps, and so the orders go away every year. It certainly is easier, and possibly cheaper and better than raising our own; yet the feeling that we should do so is a right one and should be encouraged.

So far, little irrigation is practised in any commercial cherry orchard in South Africa. Given the soil conditions mentioned, there should be little need. Yet the time may come when greater interest will be taken in this fruit in those areas which are suitable, and the need of irrigation may arise, if not from a cultural point of view, perhaps from that of a mercenary one.

It is by no means a bad plan to give the cherry a good watering at blossoming time. It helps the fruit to set if rains are delayed and provides the moisture the trees might otherwise lack. At the close of the season, after the fruit has been picked, there is something in the appearance of a cherry tree which reminds one of a hen in moult; the trees have an unhappy expression, and if rain does not fall an irrigation would be much appreciated. However, our rains should commence about the time the cherries have been picked. These are the cultural reasons for irrigating the cherry tree.

The mercenary one has not yet been put before any South African cherry grower. It is quite simple. When a cannery wants cherries, they want fine large fruit. It pays them better to put up fine fruit. For that reason the canner may propose to the grower that he irrigates his trees in order to make the fruit size up. An experienced San Jose canner once offered the author 6 cents per lb. for all the water he could deliver to the Golden Gate Cannery, provided it was contained within cherry skins. In any case, though it may not be likely that irrigation of the cherry will ever be resorted to in South Africa, it should be noted that, when soils begin to dry out owing to lack either of rainfall or cultivation, an irrigation would be of the greatest benefit to the trees.

A distance of 25 feet apart, with the trees set out in squares, seems to be about right for the cherry tree in South Africa. A good deal depends on the natural habit of growth of the variety. Thus, Black Tartarian is always an upright grower, whilst Napoleon Bigarreau is a tree with widely spreading branches. With the advance of knowledge in connection with cross-pollination it is not

likely that a large acreage would be planted out to any single variety, so that a distance of 30 feet—which might not be too much for an orchard of Napoleon Bigarreaus—need not be discussed. Personal experience has afforded the author knowledge that, without the right variety to cross-pollinate, some of the most valuable sorts refuse to bear. Amongst the items gleaned in a troublous time were the following:—

That the Governor Wood, though not regarded as a specially good variety itself, owing to its being what may be termed a soft fruit, proved the best for pollinating Black Tartarian and Napoleon Bigarreau, and, being planted in proximity to these kinds, made them from light into heavy and regular bearers. The Governor Wood is a self-fertile variety and amongst the most useful to plant for cross-pollination purposes, although it certainly does not affect all kinds of cherries the same way. A glance at Mr. Rainier's local experience will show that his mixed lot of varieties has never failed to bear heavy crops. We have not sufficient knowledge at present of the correct pollinating varieties for every sort of cherry we grow to make a definite pronouncement, but it may safely be said that to plant orchards of solid blocks of any one variety of cherry would be a grave mistake.

The question of pruning the cherry is one which the author decided years ago had better be dealt with on very moderate lines indeed. In fact, after the tree has been put in the way of attaining its proper shape, pruning is unwise. Planting the cherry should always take place in or about the month of July, when the trees are dormant. When purchasing young trees they should be selected with a single straight stem and cut back, after planting, to the uniform height of 20 inches; the cut should be painted over.

Not more than three leaders should be allowed to grow during the first season; these should be properly placed and spaced round the stem, so that they may form a symmetrical tree and not all start out from the same spot on the trunk, as they may wish to do, but be allowed a space between each branch of 4 inches at least. At the end of their first year's growth they should be cut back (in July). The amount of growth to be removed depends on the vigour the young tree has displayed. It is pretty safe to say that at least one-half of the first year's growth should be cut off. That would leave the tree with three branches, each about 12 or 15 inches long. These are allowed to produce two growths each and these are again cut back in July, leaving a little more than previously. That gives the little tree six branches.

A further pruning the next season, with perhaps a growth of 18 inches or so left, will see the tree with about twelve branches.

After this third pruning, which should follow on the previous

lines, the shape of the future tree will have been to a certain extent decided. It will be sufficient for future pruning to be confined to the removal of interfering branches. Each year more branches will grow out, and they must be dealt with by selecting the most suitably placed to be allowed to remain, and those not required must be cut off close up to the branch from which they spring. The cutting to outside buds in the case of an upright growing tree and to inside ones in trees of a spreading habit should be observed. All large cuts, such as may be necessitated by the breaking of a limb from any cause, should be made in the summer time. After the crop is off, it is a good plan to go round the orchard at that time and do any cutting which may be needed, then by the end of the season most of the cuts made will be grown over.

In the fourth and fifth years many varieties will begin to give a little fruit. Soft sorts, such as Governor Wood, are the first to come into bearing and the last are those of the Bigarreau type, such as Monstreuse de Mezel and Napoleon Bigarreau. Pruning the cherry tree by annual cutting back, such as is applied to many stone fruits, once the tree is properly shaped, tends to induce gumming, which is the worst trouble to which the tree is subject. All large cuts should always be painted over as soon as made.

The methods of cultivation mentioned in the chapter on that subject must be adopted in the case of the cherry orchard. Deep ploughing is regarded as a necessity on account of its greater mulch-forming and consequent moisture-retaining features. Twice a year is not too often to plough. Often one deep ploughing is considered sufficient, and this may be the case on the lighter soils. On the heavier ones two ploughings should be observed and the necessary cultivation be maintained throughout the season. The number of cultivations needed will depend somewhat on the class of soil and largely on the rainfall. In naturally dry or gravelly loam, more frequent cultivation is necessary than on soils of a moister nature. The cherry responds more fully than most other fruit trees to good cultivation methods, and what is termed clean cultivation gives the best results. The turning-under of a weed crop is desirable and furnishes very necessary humus.

The cherry tree is particularly sensitive to the application of manures of a nitrogenous nature, and shows its appreciation of them by the deep healthy green colour assumed by the foliage. Cover crops of Kaffir or velvet beans are useful. It must be borne in mind that although the tree delights in nitrogenous fertilisers it is a fatal error to give heavy dressings of such commercial fertiliser as nitrate of soda or sulphate of ammonia; the results show themselves in the better appearance and growth of the tree, but this is often accompanied by a falling-off in the crop. What is termed a

" complete " fertiliser is necessary if good and regular crops are to be secured and it may be made up approximately of 300 lb. bone meal and 150 lb. each of nitrate of soda and sulphate of potash; for full-bearing trees and for old ones a larger dose may be given.

The cherry is one of those trees on which the use of ordinary farmyard manure has a good effect. Old and well-rotted stuff is the best to use. An outstanding feature in the cherry tree is the reduction in the size of the fruit if the land is allowed to become poor. The smallness is even more noticeable than the reduction in the crop. This is perhaps because at the best it is a small fruit. One should not take two bites at a cherry, we are told; on the other hand, no one wants two cherries at a bite, and so one has to fertilise as soon as the tree begins to bear heavy crops, in order to maintain the fertility of the soil and both the quality and quantity of the fruit.

Gumming is the chief disease affecting the cherry. Occasionally if left alone it will be severe enough to destroy the tree. Gum exudes through the bark, in some cases forming lumps and in others running down the branch on which it may appear. If allowed to remain the affected bark decays, and the wood underneath is in danger also. Gumming, as has been stated, may be induced by pruning, also by over-irrigation and insufficient drainage. There may be other functional troubles which will induce the disease. It does not appear to have been the object of much research. Whatever may be the cause, the remedy in all cases seems to be the same. It consists of removing all the affected bark, cutting it away with a sharp knife for some little distance round the gumming surface and painting the exposed parts with Bordeaux paste. A second application is advisable later on when the gumming starts again, as it often will. Slitting open the bark is often done, in order to allow the free passage out of the oozing gummy matter, and doubtless this relieves the situation.

After the crop is off and the annual clean-up is undertaken is a good time to go over the cherry trees, washing out the crotches with Bordeaux paste to remove the gum and disinfect against further possible trouble, and doing any necessary work in connection with making large cuts where necessary, being careful to paint all of them over with the paste.

Varieties.

There are many varieties of cherries grown in South Africa, but only a few may be regarded as of commercial value. First in importance comes the Bigarreau type, which includes Monstreuse de Mezel, Napoleon Bigarreau, Black Bigarreau and Rockport Bigarreau. Of these:—

Monstreuse de Mezel is probably the best cherry for South Africa.

It is very similar in habit and growth to Napoleon Bigarreau, both having strong-growing and wide-spreading branches. The fruit is of the largest size with firm flesh and sweet flavour, colour yellowish to dark red, getting very dark if fruit is allowed to hang long enough on the tree. It is an excellent canning cherry. Ripens early in November.

Napoleon Bigarreau. The most popular cherry in California, where it is known as Royal Ann. Does well in South Africa in those spots where it can be grown. Habit of growth is strong and spreading. Fruit of the largest size with firm, crisp flesh and good flavour. Not as sweet as Mezel and colour not as dark. The shape of both is similar and the fruit produced in bunches. The best canning cherry. Ripens early in November.

Black Bigarreau is described by Messrs. Pickstone as a strong upright grower. Fruit large, colour dark red to black. Ripens after Black Tartarian and is similar in appearance. Ripens November 15th to December 1st. (It also bears its fruit in clusters, is a firmer cherry than Black Tartarian with shorter stem; a good bearer when properly pollinated.)

Rockport Bigarreau is little grown here. It is a good cherry, tree of spreading habit of growth. The fruit is of fair size, yellow shaded to pink, flesh softer than Mezel and Napoleon and ripens a little before either of those varieties.

Heart Type.

This includes the following, all of which ripen earlier than the Bigarreaus and also come into bearing at an earlier age, starting at four or five years, while some of the Bigarreaus take seven or eight years before they bear. The fruit is softer and does not carry as well as the above. The light-coloured kinds are used for canning and are very fine as eating fruits.

Governor Wood. The tree has a somewhat spreading habit of growth, but not as much so as Napoleon Bigarreau, and is an excellent and early bearer. The appearance of the fruit is not unlike that of the last-mentioned variety, but is of lighter colour, never getting the deep red of that fruit. The flesh is tender, sweet and juicy, and of good flavour. The fruit is amongst the earliest, ripening the first or second week in October.

Black Tartarian. The favourite black cherry everywhere. Tree upright, vigorous and healthy; a good grower and bears large-sized fruit, which turns from red to deepest red and almost black when fully ripe. Flesh is soft and tender, very sweet and juicy, of purple colour and delicious flavour. Ripens end of October and later.

Emperor Francis is one of Mr. Rainier's favourites, and is an excellent fruit. Habit of growth, spreading, fruit large but not as

large as a well-grown Black Tartarian; flesh fairly firm, sweet and of good flavour. Colour red to darker red. Ripens a little later than Tartarian.

Elton. This a favourite American variety for eating and canning purposes, but not a particularly good carrier, being only slightly better than Governor Wood. The tree is a handsome one, not too upright nor yet too spreading. It bears a pretty yellow cherry, shaded to light red, with medium tender flesh of delicious flavour. It is the most pointed in shape which we have. Ripens after Governor Wood.

Bedford Prolific. An English variety which does well here. The tree is a fine grower, somewhat spreading in habit and a heavy bearer of dark reddish to black fruit of fine quality and flavour. Shape exactly opposite to Elton, being rather flattened than elongated. Ripens middle to end of October.

Early Rivers is another English variety of good repute. Tree spreading rather than upright, bearing somewhat soft fruit of similar colour to Bedford Prolific, but is elongated in shape. Turns from red to dark red if allowed to hang on the tree, not a fruit for shipment. Ripens middle of November.

Morello.

This is another type of fruit entirely, and is not an eating cherry. It is *par excellence* the brandy cherry, and is used in the production of the best brands of cherry brandy; also for pies and cooking purposes. The tree in England is frequently grown trained against a wall with a southern exposure. This is partly owing to its weakly habit of growth and partly to get all the warmth possible. It does not make a good standard tree. It bears fruit of a large size, colour dark red, almost black; flesh soft and juicy. Ripens late and is but little grown here.

CHAPTER XV

THE PEACH AND NECTARINE

History; Classification; General Adaptability

Like so many others of the fruits now grown in South Africa, the peach was introduced by Van Riebeek in the very early days of the Dutch Settlement at the Cape. Nothing can now be said as to the varieties of the trees which he imported, but it is pretty safe to hazard a guess that the common yellow peach of South Africa was one of the sorts, perhaps the only one, which survived. This idea is supported by the fact that most of the varieties of the peach with which we are familiar to-day have only been introduced within a comparatively short recent period.

The peach has been grown in China from time immemorial; it is possible that it was taken thence to Persia and again at a much later date to Western Europe and from there to America.

Waugh, in his "American Peach Orchard," quotes from a famous book published in 1803, the American edition of Forsyth's "Culture and Management of Fruit Trees."

"Peaches are in some variety and ripen to great perfection in the Middle and Southern States. It is a fruit that is so natural to the country that they are applied as food to hogs, also in making brandy and for culinary purposes. They are generally divided into clear stones and clingstones: the clingstone sorts are in France called 'Pavies.' In a list of thirty-nine varieties given by Mr. Forsyth, only six are received by the French as 'Pavies,' or clingstones, and it seems in France and England the clear stone sort is preferred at their tables."

Types.—Peach growing has made wonderful strides since that time, and the number of varieties has multiplied almost indefinitely. The different types of peaches, principally represented in South Africa, may be classified as follows:—

(1) The Chinese type, embracing the Peen-to or Flat Peach of China group, which embraces the numerous crosses which have taken place with that peach and includes Angel, Waldo, Jewel, Pallas, all of which, with a good many others, have originated in the Southern States of America.

(2) The Chinese Cling Group, which is made to include

Elberta—although not a clingstone variety—Shanghai, Seller's Cling, Philip's Cling, and possibly our own Yellow Cling peach.

(3) The Persian type, including the Crawfords Early and Late, Foster, Amsden, Alexander, Waterloo, Salway, etc.

There are other types besides these and a very large and growing number which cannot be said to belong to any type, definitely and distinctly, owing to continuous crossing. It may be noted in this connection that L. H. Bailey, in his " Horticultural Encyclopedia," says Elberta is more Persian than Chinese.

Leaving such matters as these and coming down to simple facts, we find in South Africa that the peach family is divided into four distinct classes.

(1) White Freestone; (2) White Clingstone; (3) Yellow Freestone; (4) Yellow Clingstone, and it is convenient to deal with them by means of that ordinary classification.

White Freestones.—This term includes those with light cream colour flesh, as Early Rivers, and those with white and greenish-white flesh as Brigg's Red May, and forms the bulk of our export class of peaches. Yellow types are chiefly in demand for local markets, for dessert, canning and drying purposes. A few have recently been exported. Yellow clingstones are greater favourites with canners than any other type of peach—though occasionally used for drying. White clingstones are not much in demand, though there are a few sorts, notably that which we term White Pavie, which remain favourites.

Some American writers claim that the United States of America is the home of the peach and, as there are perhaps 100,000,000 trees and possibly more in that country, it cannot be denied that the peach family has appreciated its surroundings there and multiplied in an extremely fruitful manner.

South Africa can also claim that it is the home of the peach, and perhaps in the majority of cases a happier home than can be found in the New World. In some of the Northern States of America it is customary to pull the trees over every winter, so that they may lie on the ground and be covered up until spring comes again—then they are made to stand upright and tied in position to stakes. In South Africa, the worst that can happen to a peach tree is to be caught in a hailstorm, and as fully three-fourths of our peaches are grown in the Cape, where hail very seldom falls, that is a matter of extremely rare occurrence. What traveller by rail in the Transvaal has not noticed peach trees in blossom and, later on, laden with fruit as the train has been speeding on its way? These trees, so seen, have grown from seeds thrown from the windows of a railway

carriage and have taken root and grown in the cinders lying along the permanent way, without soil, without water or care of any kind; surely these trees are at home.

In a long experience the author has never seen the peach tree grow as quickly or bear as heavily as it does north of the Vaal River and in Natal. A young tree grown from seed will bear a heavy crop of fruit, all it can stand up under and sometimes more, in the second year of its life.

Longevity.—Although the peach has not as long a life as the apple and pear, it cannot be called a short-lived tree. There are many instances where the peach tree has lived for over forty years and been profitable for the whole of that time. These, it may be said, are the exception and not the rule. The peach begins to bear at a very early age; the third year often brings a profitable crop, that is, the third year from the planting of the tree in the orchard and not "from seed," and should continue to yield a good crop annually for at least twenty-five years. If that age is not attained, it is the fault of the owner rather than of the tree. Some unsuitable surroundings are sure to be present, such as too poor soil, water-logged sub-soil, or perhaps lack of pruning (for the knife is the life of the peach) which will cause the tree to succumb.

Control.—Left alone, with no annual cutting back or thinning out of superfluous branches, the tree will yield enormous crops and endeavour to do this annually, with the result that it overbears, becomes debilitated and dies from exhaustion or, in plain language, neglect. Even under such conditions as described here, before the final stage is reached it is possible to renew the tree by cutting away all the branches to about 18 inches or 2 feet from the trunk, painting or waxing over the wound and whitewashing the mutilated stem and branch stumps. If this is done in June, as a rule, by the December following, a new head has been formed; growths of from 4 to 8 feet long have been put out, and if these are properly cared for, it is possible to have a peach tree which will bear plenty of fruit and live for a number of years. It occasionally happens that a tree may go through the renewing process twice and still be a satisfactory tree.

To the uninitiated eye all peach trees have a similar appearance: the same kind of growth, the same kind of leaves, the same healthy look about them. There is really a wide difference between the various types of peaches, which is quickly apparent on examination of the leaves only. An inspection of these will show some types which have consistently large leaves, broad and long, whilst leaves of others may be small and narrow. Again, all peach trees have another characteristic feature: some carry at the base, near the stem of the leaf, small round excrescences or glands; others have

reniform or kidney-shaped glands; whilst others again have no glands at all. These features are constant and do not vary, so that they prove, on occasion, aids to the identification of a variety.

Also we find no fewer than three different types of blossoms. The first and most common is that of the ordinary yellow peach—a large bloom, something like that of a dog rose, only, of course, much smaller. Then there is the small, insignificant blossom of the Crawford group, and, last, the beautiful double-flowered ones of the Chinese ornamental type, so-called. These trees may still be found in many towns of Northern China, where they present a gorgeous sight when in full bloom; they are white, pink—light and dark—with variegated white and pink in addition.

Different types of peach trees also differ in the colour of the bark, especially on the twigs of the last season's growth. These may be reddish-brown as in the Alexander family or of a greenish hue as in the Peen-to group.

Environment.—Notwithstanding the varied climatic conditions which are to be found in South Africa at different altitudes, ranging as they do from a few hundreds of feet at the Cape to as many or more thousands in the Transvaal, there is no district within the entire Union in which some variety of the peach will not grow. The area is immense and embraces all sorts of soils and climates, from the hot, dry and arid Karroo to the muggy southern coast line, the bleak, bare veld of the Free State to the magnificent stretches of Northern Transvaal with its luxuriant, almost tropical, vegetation.

The experimental stations of the Agricultural Departments of the Cape, Transvaal and Natal were before Union in 1910 largely responsible for this wonderful spread of the peach tree. These stations formerly existed at Zeerust, Warmbaths, Ermelo and Potchefstroom in the Transvaal, at Cedara and Weenen in Natal, Elsenberg and Middleburg at the Cape and also at Tweespruit in the Orange Free State. They tested hundreds of varieties and determined their suitability for different areas and in many cases distributed trees at low rates in order to find out just the right fruit for any one place.

After the relinquishing by General Botha of the portfolio of the Agricultural Department, these experimental stations were, thanks to an unsympathetic and over-anxious Minister, curtailed to a large extent. The horticultural development of the country, instead of being encouraged, was discouraged and it is not because of, but in spite of, this indifference to the welfare of the fruit industry that it has developed in the satisfactory manner that it has. The horticultural stations at Zeerust, Warmbaths and Ermelo in the Transvaal, that at Weenen and a smaller one at Winklespruit in Natal, were done away with. The very obvious feature which led

to the establishment of these institutions was overlooked, that is, the securing of facts on which to base a foundation of sound knowledge. The desire to send the expert to the farmer was in itself admirable, but in a new country, entirely different from any other, it was imperative that the expert should be possessed of the necessary local knowledge to start with. This was obtainable at the stations of the Horticultural Division. It is due to the work carried out in these stations that the distribution of the Peen-to type of peach has taken place so widely. It was introduced by Mr. D. A. English, of Maritzburg, and is now to be found throughout the whole of the bush veld and low veld districts of the Transvaal and Natal. They demonstrated the adaptability of the "Waterloo" and "Alexander" type of peach to the entire high veld of the Transvaal and Orange Free State; they acted as centres of reliable information as to the types of other fruits besides peaches to be grown in certain parts of the country; they afforded opportunities of showing correct methods of packing and preparing fruit for market; they were, in some instances, self-supporting—yet they were done away with, to the lasting loss of the country.

Local Requirements.—The frequent sudden changes in local conditions, due to a drop of a thousand feet or so in altitude, have a marked effect on the suitability of certain types of peaches to different places. Thus practically all the Alexander type of peaches are a success at Johannesburg, at an altitude of close on 6000 feet —whilst at Pretoria, some 45 miles distant, at an altitude of about 4500 feet, this class of peach refuses to bear fruit.

Throughout the peach-growing areas of the Western Province the Persian and Chinese cling type succeed admirably, but the Peen-to class does not. It may be said that throughout the country each district has its own particular kind of peach and it behoves the prospective planter to make full inquiry before committing himself to the purchase of peach trees.

Thus it is a matter of the selection of varieties suitable not only to the district in which the tree has to grow, but also of the most suitable for the purposes for which they are required. Round the large towns many trees are planted in order to supply local markets. On the high veld in the neighbourhood of Johannesburg many thousands of trees are grown for this purpose alone, and it may be safely stated that these peaches are the best in Africa, of unequalled flavour and appearance, regular and prolific bearers, and, if there were no hailstorms, the export of peaches from this area would be an immense business.

It is, however, at the Cape that the peach is seen at its best, where no storms interfere with the development either of the tree or fruit. In the favoured area of the Western Province peaches of the best

class either for export, canning or drying are produced with almost machine-like precision. So many peach trees—so much fruit. No frosts to kill either blossom or fruit—practically no drawback as far as Nature is concerned. Although the largest development in the peach industry has taken place there and in the Transvaal, there are other localities where success is met with in the culture of this fruit. The Alexander type of peach as grown in the eastern portion of the Free State is amongst the best of its class, and it should be possible to export peaches from this area ten days or so before it is possible from the Cape. Large quantities are sent from the Ficksburg district to Durban, which is the principal market eastwards.

The earliest peaches in the English markets, those which arrive a week or two before Christmas, always fetch the highest prices, and instances are frequent of the first-comers being sold in considerable quantities at no less than 3*s*. per single peach. Naturally, competition is keen. The earliest variety in the earliest district is what is striven for, and a rich reward awaits the exporters of all good white-fleshed peaches arriving in Europe before December 25th.

Broadly speaking, it may be said the peaches of the Peen-to type are a success over the whole of the bush and low veld in the Transvaal and Natal, also Zululand and certain of them in the Karroo. The Alexander or Persian type of peach does best at the Cape and the high veld of the Transvaal and Free State, whilst the Chinese cling group may be found represented by some one or other variety, principally the common yellow of St. Helena, over practically the whole of the Union.

Soil and Situation.—As practically the whole of the peach trees in South Africa are worked on peach roots of one kind or another, the question of suitable soil resolves itself into the selection of the best possible peach soil without any reference to the requirements of any other root system such as plum or almond, which are sometimes used in other countries as stocks for the peach.

The peach thrives best in a light loamy soil. It will also do well in soils of a sandy, gravelly nature and in such even as may rightly be termed of a stony nature. Indeed some of the reddish loams on the high veld of the Transvaal, carrying quantities of quartz gravel, afford very excellent soil for the peach. Given a free working, open, lightish soil with good drainage—which is a *sine qua non*—there is usually little difficulty in satisfying the modest demands of the peach tree.

There should be no clay where peaches are planted, nor should "turf" ground or any other black soil be chosen in which to set out a peach orchard.

Apart entirely from the successful growth of the tree comes the

important question of the flavour of the fruit. A comparison of peaches of one and the same variety—the one grown on turf and the other on a light loam, or sandy gravelly soil—is indeed a revelation, and a trial is suggested to the reader. A similar comparison may be made between the flavour of a carp which lives a good part of its life in the mud and a trout which spends its days in quite other quarters.

Soils of a light, deep and sandy gravelly nature, without clay or " oud-klip " sub-soil are best for the peach in South Africa. Many of these are the result of the decomposition of either sandstone, granite or quartzite rocks. Of the three, the first-named, which abounds round the Cape coast and inland as well, is the poorest, yet many thousands of peaches are planted in it.

Decomposed granite soils come next; they occupy large stretches of country in the north and eastern portions of the Transvaal. They do not carry as many peach trees as either the sandstone soils or yet those of quartzite origin—the latter produce some of our best fruit. All these soils are in need of assistance if consistently high cropping is to be maintained.

The ordinary red loams which abound in South Africa are quite suitable peach soils, whilst success of a striking nature has been achieved on the Rand (Transvaal) in growing peach trees on shale. When the shale decomposes, or becomes easily permeable by the roots of the peach, it provides a very rich and suitable soil and is able to go on for a long time without any kind of fertiliser except possibly nitrogen.

The deep alluvials of the Karroo afford perfect soils for the peach where water is to be had. The only drawback to the production of the very best of peaches there is the difficulty to be overcome in the matter of water supply and brack soil. The peach tree cannot live in brack soil for more than a very few years; the leaves discolour and become yellow, neither they nor the roots remain capable of fulfilling their functions, and the tree dies.

So far, the consideration of this matter has dealt only with the growth of peaches on a commercial basis. If a man has a garden and wants peach trees let him have them by all means—even if the soil is not exactly what it should be, the trees will bear under most conditions—the prime necessity being good drainage. Like most other trees, the peach cannot put up with wet feet.

Whilst much has been written on the subject of exposures in connection with different kinds of fruit trees, there is no one tree which derives more benefit from the correct exposure than the peach. If it is possible, a gentle slope should be chosen having a frontage to the north and east. The morning sun has a beneficial effect, inducing healthy vigorous growth and early ripening of

fruit alike and its rays need not be feared here as in less favoured lands, where, after a frosty night, smudge fires have to be lighted in the small hours of the morning, in order to provide a smoke screen between the fruit trees and the sun. Both the peach tree and fruit like as much sun as they can get—even the system of pruning is ordered so as to enable the sun's rays to come in contact with and so colour the fruit. The rosiest cheeked peaches are those which get the most sun, and they are also the best sellers.

The selection of a gentle slope is not particularly mentioned because of the " slope " itself, but because it is pretty sure to lie at some slight additional elevation above the surrounding land and because of that fact the trees are in a warmer atmosphere at night, being out of the cold air, which always settles in the lowest levels at that time.

Trees so grown always produce earlier fruit than others of the same variety planted out in the open or along the banks of a stream or river. Exposure to cold and high winds is to be avoided, as although the peach " sticketh closer than a brother " to its parent twig, and it is a rare occurrence to find a peach blown off, there is no doubt that such winds are liable to reduce the blossoms and to injure the crop. For that reason, therefore, the sheltered portions of a farm, all other points being satisfactory, are best for peach culture.

Methods of Propagation; Orchard Planting and Maintenance

Scarcely any other stock is used on which to work the peach besides the peach root itself. There are, however, exceptions and the principal one is the " peach almond "—a nondescript kind of fruit midway between a peach and an almond. It is quite useless as a fruit, but the kernel finds a market at the confectioner's. The tree is a particularly hardy one and perfectly suitable for a stock for any other kind of stone fruit and eminently so in those parts of the country where brack either in soil or water is to be found. Some nurserymen in the Cape Midlands use " peach almond " as a stock to the exclusion of all others on account of its great immunity to the effects of brack. It is claimed in addition that stone fruits of all kinds, when grafted on this stock, ripen earlier than when worked on either self stocks or on peach. It is worth following up.

The peach is, however, the stock generally in use. It has been the custom for nurserymen to purchase peach pits in bulk from the different canneries and this practice was almost universal. Recently a tendency has arisen to confine purchases to the seed of the common yellow peach, which is extremely hardy against all troubles except-

ing alkali (brack). The tendency should be encouraged, as a sound hardy stock is likely to produce a sound hardy tree if it gets anything like a fair chance. It must be very clearly pointed out, however, that the indiscriminate purchase of yellow peach pits for propagation purposes is strongly to be condemned. Buyers should know something about the trees from which the pits are taken, as to whether they are healthy and vigorous, or old, sun-scorched and decrepit. Seeds from the latter should be rejected.

Crown Gall.—An unpleasant feature has come to light recently in an accentuated form, and that is the disease called " crown gall." Although this has been known to be present in South Africa for thirty years at least (the author has known it for that period), it has recently been attracting a good deal of attention over a widespread area. Not only do the trees become affected, but also the soil in which they stand, and one should be most careful in selecting seed for propagation purposes, as it has not yet been definitely proved that " crown gall " may not be transmitted through the seeds. Pits from slightly infected trees have produced roots affected with the disease when planted on virgin soil.

Nurserymen have not the time to collect, and do not in the ordinary way trouble to secure, pits from specially early ripening sorts of peaches. There is a strong feeling that a stock grown from seed of an early ripening variety, such as Jewel or November, will influence any other variety worked on it in the direction of early maturing of fruit. There is something in this, but not to the extent that is generally supposed.

Perhaps it is necessary to mention the objection to the use of stocks other than the peach as graft-carriers for that fruit. The plum has been recommended and to a very limited extent used in South Africa as a stock for the peach in soils too damp for ordinary peach roots. There is no doubt but that by the use of the plum roots peaches can be planted in damp soils, but neither the peach tree nor the fruit it produces cares about damp soils; they do better on dry ones. The growth of the peach, worked on either of the plum stocks in common use here, that is, Myrobolan and Marianna, is, after all, a stunted affair when compared with the peach on its own roots. The use of the plum stock has been discontinued principally on account of the dwarfing effect it has on the growth of the peach worked on it.

Another stock, once and very occasionally still used for the peach, is the almond. There are two reasons why the almond has been finally discarded as a stock for the peach. First, the union of the bud or graft is a weak one and many trees have been lost, due to having been blown off their roots in a high wind. Secondly, the continued use of the almond as a stock for the peach tends to make

the fruit less luscious and juicy than when it is grown on its own roots; it is a common thing to hear the expression " dry " applied to peaches grown on almond stocks, and dryness is the last thing one wants in a peach.

Orchard Planting.—The peach is often used as a fifth tree, or " catch crop," on account of its early bearing. As a rule, it is planted in this way as the central one of five trees. The permanent trees may be apples, pears or walnuts, which take much longer to come into bearing. Such trees as these are seldom planted at a lesser distance than 24 feet apart—the walnut 40 feet—so there is plenty of room for a peach tree in the middle of each square. The one thing against this practice is that it is often difficult to pluck up courage enough to uproot the peach trees at the proper time. One hates to destroy a profitable tree, and so they get left so long that they sometimes injure the permanent trees by encroaching upon the land which they will eventually want for themselves, to their detriment.

Many peach orchards are planted, however, purely and simply for the production of peaches as a permanent crop and then the matter assumes a different aspect. In the Northern Provinces the peach tree grows quickly and attains a very large size. It is therefore wise to allow plenty of room, and the usual distance for planting is 24 feet apart, either in squares or equilateral triangles.

At the Cape, growth is less rapid, and the trees do not grow as large; the necessity of such wide planting, therefore, does not exist, and 20 feet may be said to be the usual distance at which the peach should be planted there. Consideration should also be given to the varieties planted for the sake of pollination. Some peaches, such as Early Alexander and the Briggs Red May, are recognised as light croppers, although most profitable to grow when bearing well; every effort should be made therefore to encourage bearing, and pollination by suitable fertilising varieties should be ensured. Scarcely any information is available as to the best varieties to use for that purpose—a good deal of work therefore remains to be done in that direction.

Planting is best done during the months of June, July and August. The Chinese types should be as a rule planted as early in the season as possible. They do not remain dormant as long as other types of peaches. Selection of varieties will also depend, apart from the question of pollination, upon the eventual destination of the crop. Export sorts embrace all the red-cheeked, white-fleshed types, preferably freestone kinds; canning and drying kinds are all yellow fleshed.

During the first year or perhaps two years of the life of the tree it is permissible, where they are planted not less than 20 feet apart,

to plant a catch crop of vegetables of some kind between the rows. Three or four rows of mealies planted not less than 4 feet from the trees may do good by acting as windbreaks; peas, beans and pumpkins will do more good than harm and also turn in a little money.

Pruning.—It has already been stated that the knife is the life of the peach tree. Pruning is essential every winter, and summer work of

ONE-YEAR-OLD PEACH TREE, UNPRUNED. (PLANK NEK PEACH PLANTATIONS, TRANSVAAL.)
[*Photo by H. B. Davis.*

ONE-YEAR-OLD PEACH TREE, PRUNED.
[*Photo by H. B. Davis.*

a similar nature is often necessary. The question of pruning is always a matter of controversy; there are so many different opinions about it and each different method has its advocates. This is specially so in the case of the peach. So many different ideas are held on the subject that agreement on all points is out of the question.

The Cape growers who export large quantities of peaches require the finest fruit it is possible for them to produce. Size, colour and general appearance are the points which they want to concentrate on in their product. They prune their trees accordingly.

The yellow peaches are wanted in bulk for drying purposes and the trees require different treatment. In all cases without exception, the peach bears its fruit on the new wood, *i.e.*, wood of the previous year's growth. It is necessary, therefore, that pruning should be so conducted as to dispense with as much old wood as possible and retain as much of the new as one can. This seems rather difficult to undertake, but becomes quite simple as one gets used to the work.

A natural consequence is that the larger the tree becomes the further away from the trunk the fruit is produced. It follows that the bulk of the crop is carried on or towards the end of the branches. These are liable to be exposed to the sun and suffer from sun-scald if they have not sufficient leaves to provide shade. This necessitates the constant renewal of spurs and laterals for the purpose. Growths of some kind should be maintained from the bottom of the tree to the top in order that constant bearing over the whole of the tree may be ensured and full vitality may be maintained throughout the entire organism; this is attained by the pinching back of the new shoots and judicious cutting during the annual winter pruning.

The peach should be headed 18 to 20 inches from the ground. After the tree is planted, it should be cut back to that height and have very much the appearance of a stick stuck in the ground. It is better to purchase trees trained to a bare stem than to get them from the nursery with the heads already formed. As the new growths appear, three of them should be selected to form the main branches of the future tree. The remainder should be cut off. At the end of the first year, actual pruning work commences and must be continued with the final shape of the tree and spread of the branches always present before one.

Shaping.—The vase or goblet shape described in the chapter on pruning is most largely adopted. Cape growers limit the number of branches to comparatively few. The centre of the tree is left hollow in order that the sun may penetrate and so help produce that rich red colour so much desired; also that plenty of air and light may be admitted and that no obstacle may be there to prevent the penetration of any spraying materials which it may be necessary to use. Bearing this prominently in mind, the training of the outside branches must be undertaken so that the tree may obtain a large spreading head. Upright training is disastrous, as it results in a tree which, owing to lack of room above, is not able to carry big crops of fruit.

In some instances, the first and second years' growths are allowed to remain fairly upright, so that animals may be able to get as close to the tree as possible for ploughing and cultivating; but the third

FOUR-YEAR-OLD PEACH TREE, UNPRUNED. (TRANSVAAL).
[*Photo by H. B. Davis.*

SAME TREE PRUNED, TAKEN FROM A DIFFERENT ANGLE.
[*Photo by H. B. Davis.*

pruning should see the lateral growths, trending outwards, left, so that the tree will have the opportunity of developing a good wide-spreading head. If large crops of peaches are wanted, the only tree to produce them is one with plenty of room in the top.

South African Practice.—When the author arrived in South Africa from California in 1898, he thought he knew all about pruning the peach tree; he found, however, that he had to discard all or nearly all of the California teaching and start afresh. Different types of peaches require different handling. Most of the Persian types should be pruned when in bloom, in order that no mistake should be made in cutting away too many fruit buds. When the blossom is open, it is easy to see just what you remove when you cut. If trees of this class are pruned before blossoming, one may cut to a certain length, leaving flower buds from which fruit may be expected below—such buds frequently drop off and a short crop is the result.

With most of the peaches of Chinese origin, the practice of pruning when the tree is fully dormant may safely be adopted. So prolific are these peaches that practically every flower may be depended upon to bear fruit. This enables one to cut with impunity and leave as nearly as possible the right quantity of fruit on the tree. This type of tree is much more liable to overbear than any other and the fruiting twigs may be thinned out freely, removing them entirely. Cut all that remains back to not over 6 inches in length as a rule and never leave long, straggling laterals; these will, if allowed to remain, produce fruit from one end to the other. They are unsightly and weaken the tree.

Many thousands of trees used to be pruned in California by Chinamen; they were not all skilled men, but they posed as such. The one object they all endeavoured to attain was to cut every single bit of young bearing wood back. This may be done in South Africa with the Chinese peaches to advantage, but with no others.

Summer pruning of the peach is largely resorted to. The centres of the tree would become choked with new growths if they were not removed, and this must be done if the open centre is to be maintained. Many Transvaal growers object to the open centre system of pruning the peach. They say when there are no branches in the centre of the tree and if hailstorms occur, the hail goes right through the tree and leaves nothing in the way of a peach. On the other hand, if all the branches are not removed, there is something to break the force of the storm and a few peaches at the bottom of the tree are saved. It is a matter of individual choice.

Fruiting spurs and laterals appear along the branches during the seasonal growth and many make a practice of cutting these back about January, with the object of forcing out fruit buds for the

following year's crop, instead of leaving them alone to throw out fruit and other buds naturally. The class of pruning termed "spur pruning" is frequently done in order to induce the fruiting habit in trees which have been too busily engaged in growing to produce fruit, and when the trees are old enough to bear fruit and do not do it, there is no reason why this method should not be adopted.

When the peach tree has been pruned during the blossoming time, the work of thinning is very considerably lessened. Notwithstanding the pronounced dislike which was formerly prevalent in South Africa to the thinning of peaches or indeed any kind of fruit, the custom has come to stay.

The intelligent grower knows that it is not sound business to allow the trees to overbear; it not only impairs the vitality and shortens the life of the tree, but reduces the value of the crop it actually does bear. The finest export peaches fetch better prices than small ones—on occasions double. It takes less than half the time to pick, pack and market one box of fine peaches than it does to pick, pack and market two boxes of small ones. Whether for export, canning or drying, the large peach fetches the highest price. It appears, therefore, that the case in favour of thinning has been successfully made out.

The time for thinning is before the pits harden—the actual size of the fruit is not of much moment. It may be anything from a hazel nut to that of a small walnut. The work should be done thoroughly, no peaches should be left on any twig at a less distance than 6 inches apart. Even then they should be left on opposite sides of the twig, in order than an even distribution of the sap should take place. Many think 6 inches is too great a distance and are afraid to ruin the crop by such so-called drastic thinning. Assuming that these peaches when fully grown will be only $2\frac{3}{4}$ inches in diameter, it will be seen that any distance less than 6 inches would be fatal to the production of good fruit. There is no truth in the tale that it is customary in some parts to tell a boy to thin peaches by picking off all he can see, but it does illustrate the advisability of thorough methods of thinning. Misshapen or double specimens should always be taken off at thinning time. Thinning should be undertaken if only to prevent the breaking down of branches, which would surely occur if they were allowed to mature all the fruit they would bear.

Very little in the way of irrigation is done in South Africa in the culture of the peach. In the principal peach-growing districts irrigation is unnecessary, though there may be here and there an occasional instance, due to local conditions, which have proved unkind and where little rain has fallen. Watering the peach may, however, be of use from two different view-points, *i.e.*, early ripening

of the fruit and increased size. The former has more interest for Transvaal growers than those in any part of the Union, for the Johannesburg market is the best in Africa for early peaches and they are much sought after. They ripen from October onwards, according to the district and the variety, and if the trees receive a few gallons of water each about three weeks or a month before ripening, and the soil is, as it should be, a light one, the effect will be to hasten on the date of ripening. If the soil should not be a light one the effect is less marked and may scarcely be noticed. Large quantities of water will increase the size of the fruit, but the ripening is liable to be delayed rather than hastened by this practice. It is better, from all points of view, if it is decided to irrigate the trees to induce the production of large fruit, to give water twice or even three times at intervals than to give what may be termed a " good soaking." Irrigation for this purpose should be done when the fruit is half grown and again when within a month of ripening. It will be found that the flavour will not deteriorate to any extent if the latter style of watering is used.

As is the case with most other fruit trees of no matter what kind, the peach appreciates a little water after the crop has been taken off. It is possible almost to see the trees brightening up immediately. In addition, this watering helps materially in the maturing of fruiting buds for next year's crop, and in those districts where rains are apt to come late is of considerable assistance in maintaining a sufficiency of moisture in the ground.

The right time to pick peaches depends entirely on the use to which they are put or the market to which they are destined. Peaches for export should be well coloured and within a day or two of ripening. Practice alone will enable the grower to decide upon the exact period, but the fruit must be taken from the tree whilst still hard. It is a mistake to allow it to become almost ripe on the tree and then to pick it. It may even arrive at its oversea destination in a condition almost perfect, but unless sold and eaten within a day or so the fruit will not " hold up " and a loss may be expected. On the other hand, fruit which is shipped from Capetown within a day or two of maturity will arrive in London in much the same condition as it left South Africa and remain in condition for many days, affording the selling agents sufficient time in which to dispose of it to advantage. It has not to be sold in a hurry, as is the case with ripe fruit. It does not go to waste on the hands of the agents, and satisfactory sales are made. This suits everyone and can be brought about by careful observations of the right time to pick. The method of picking, etc., is dealt with in the chapter on export fruit.

The demand of the canneries for peaches is that the fruit must be

" coloured but not ripe," that means, not quite ripe, but sufficiently so to allow of the softening of the fruit after it is canned. A peach may be " coloured but not ripe " and be really so unripe as to remain in that condition and be hard after being in the can for six months.

Clingstone peaches are now preferred by the canner; the flesh is more solid and is not as readily bruised as the more tender freestone varieties. The flavour is considered richer and better. Canning on a commercial basis calls for yellow-fleshed peaches only; they are mostly varieties which are useless for export purposes and so constitute quite a different demand on the growers' powers of observation. What the canner wants is a good-sized peach of about $2\frac{1}{2}$ inches in diameter. Prices are ruled largely by the size of the fruit. Fine fruit means a saving of labour costs, apart from an eventual higher price. Smaller sizes are also in demand.

The best peaches for drying purposes are found amongst the yellow freestones, such as Muir, Elberta, the Crawfords, etc. The demand for dried peaches is good, and will continue to be so. The quality of our South African article compares favourably (at its best) with that produced in any quarter of the globe.

Grading for export is compulsory. It is generally carried out in the pack-house, and is done by passing the different fruits through holes in the grading board. These grades are classed as:—

Extra Selected $2\frac{3}{4}$ in. Selected $2\frac{1}{2}$ in. Choice $2\frac{1}{4}$ in. Graded under $2\frac{1}{4}$ in.

Local Markets.—The local market for the peach is quite an important one. Very early fruit fetches extremely high prices. The first on the market is the Jewel, closely followed by Waldo—both Peen-to types; then, about the last week in November, the Inkoos comes and other varieties of this class keep the market going until the end of the season.

There is, unfortunately, no recognised standard box for local use. Frequently the ordinary export box is used, and these are to be commended. The Capetown market shows peaches in baskets as well as boxes. These are mostly from the immediate vicinity. The only safe method of handling fruit for the local markets is in the wooden box. Grading for size and colour is not general, but it may be said that this pays for the local as well as for the export trade. Fresh peaches, nicely packed in attractive boxes, are always readily saleable.

South African Varieties.—Not many useful varieties have been originated in South Africa. This is to be regretted, as it goes without saying that a peach originated here should thrive better than an exotic variety. Those which are worth mentioning are Constantia and Schoongezicht—both excellent peaches and old Cape pro-

ductions; Brook, a seedling of Early Crawfords, originated in the Transvaal as a chance seedling by Mr. A. T. Brook, of Silvertown, Pretoria; Van Rensburg, an Orange Free State seedling of the old St. Helena peach, first grown by Mr. Van Rensburg, of Ficksburg; Vaal Mammoth, another seedling of an old South African kind known as the Nooiens Persike; Natal, originated in that Province. Last and best of all is the Inkoos, originated in the orchard of Mr. H. O. Arton as a bud sport of the Alexander and carefully watched and looked after by him.

There may be, in fact are, many others, but the above are the only ones which have been propagated by nurserymen to any extent. The kinds principally grown are mentioned below and the most suitable districts in which to grow each variety are also named.

Angel.—Of the Peen-to family; medium size; round with slight point; colour red nearly all over; flesh white, juicy with slight nectarine flavour. An early peach ripening in December. Suitable for bush and low veld, Transvaal, Natal and Eastern coast lines. Dessert purposes only.

Briggs' Red May.—Originated in California about 1870; size, medium to large; shape round; greenish-white skin, almost entirely covered with red blush; flesh, greenish-white, juicy and melting; half clingstone. Ripens December. Suitable for Western Province of the Cape and high veld of the Orange Free State, Natal and Transvaal. For dessert purposes only. A good export variety.

Belle Bauce.—Not largely grown, but an excellent peach; large size; shape round; skin red; flesh white, juicy and melting; half freestone. Ripens January. Suitable for high veld of Transvaal, Orange Free State and Natal, also the Western Province of the Cape. A good dessert peach. Will export.

Brook.—A Transvaal seedling of Early Crawford; originated as a chance seedling in the garden of Mr. A. T. Brook, of Pretoria, and submitted to the author in 1905. Resembles its parent very much, but unlike it will bear heavy crops in the bush and low veld of the Transvaal and Natal. The fruit is large, round, with a small point; yellow skin almost covered with a deep red blush; flesh yellow, of good Crawford flavour: fairly firm with red round pit; freestone. Ripens January to February. Fair drying and canning peach.

Bell's November (sometimes called Edward VII).—Peen-to type; medium size; shape rounded, slightly pointed; colour full red; flesh white, juicy and melting. Ripens October to November. A dessert peach only. Will not export. Does well in the bush and low veld of the Transvaal, Natal, midland and coastal districts.

Constantia.—An old Cape variety. Size, medium to large; shape

round; skin greenish, almost entirely covered with red blush; flesh white, juicy and melting; good flavour. Ripens January. A first-class dessert and export variety. Does best in the Western Province of the Cape.

Crimson Glande.—A well-known variety at the Cape. Fruit large; shape round; colour very dark red; flesh white; very juicy and tender; red at centre, stone stained with red. Ripens in January. An excellent dessert and export variety. Suitable for Transvaal and Natal high veld and Western Province of the Cape.

Doctor Hogg.—An old favourite English peach. Size medium; shape round; skin yellow with red mottled cheeks, often solid red; flesh white and juicy; melting and of excellent flavour; red at centre with red pit. Ripens in January. First-class dessert and export peach. Suitable for Transvaal, Orange Free State and Natal high veld, also the Western Province of the Cape.

Duchess of Cornwall.—A comparatively recent introduction from England. Size medium; shape round; skin red; flesh white, juicy and melting. Ripens slightly later than Alexander. The two sometimes overlap. Fine export variety. Dessert only. Suitable for high veld of Transvaal, Natal, Orange Free State and Western Province of the Cape.

Duke of York.—Another English peach of good quality. Size medium; shape round; skin almost covered with red blush; flesh white, tender, melting. An excellent export and dessert peach, ripening next after Alexander. Suitable for the high veld of the Transvaal, Orange Free State and Natal, also the Western Province of the Cape.

Early Alexander.—An American variety similar to the last two mentioned, but the tree is not as good a grower as either of these. Has a tendency to start growth at the wrong place, but has been a favourite peach. Size medium to large; shape round; skin green, almost covered with red blush; flesh greenish-white, juicy and tender and of good true peach flavour; half freestone. Ripens early December. Was formerly the earliest good export peach. Is a first-class shipping and dessert variety. Suitable for the high veld of the Transvaal, Orange Free State and Natal, also Western Province of the Cape.

Early Crawford.—Formerly one of the most popular varieties in America and still planted there. Size large to very large; shape rounded with pointed "nose"; colour yellow with red cheek; flesh yellow, tender and with a most distinctive rich flavour; freestone. First-class drying, canning and dessert peach. No export demand at present but may come later. Suited to the high veld of the Transvaal, Orange Free State and Natal, also the Western Province of the Cape.

Early Rivers.—Originated by Thomas Rivers of England, and is one of the choicest of all peaches. Size large to very large; shape roundish but somewhat pointed; skin creamy yellow with reddish blush; flesh cream colour, juicy, tender and melting; freestone. Ripens early January. Choice dessert fruit and a favourite on London markets, but requires special care in handling. Suitable for the Transvaal, Orange Free State, Natal high veld, also Western Province of the Cape.

Elberta.—One of the most widely-grown of American peaches, originated in the State of Georgia, famous for its peach orchards. Is large to very large in size; shape round, somewhat slightly flattened and ends in a point; colour yellow with red cheeks; flesh yellow, juicy and sweet; slight Crawford flavour; freestone. Ripens February. Is one of our best drying and canning varieties and a good dessert fruit. Has been exported and experienced a slight demand. Suitable for the high veld of the Transvaal, Orange Free State and Natal, also the Western Province of the Cape.

Florida Crawford.—Originated in Florida, U.S.A., introduced into South Africa by D. A. English, of Maritzburg, and has proved a success. Size large to very large; shape roundish with pointed end; skin yellow with deep red blush; flesh yellow, not particularly tender or juicy, but with real Crawford flavour; red at centre; freestone. Ripens mid-season. Is good for canning and drying; to a lesser extent for dessert. Is not an export peach. Does best in the bush veld and low veld of the Transvaal, Midlands of Natal and Eastern Province of the Cape. Will grow in the Western Province, but not wanted there as both Early and Late Crawfords do so well.

Foster.—A beautiful American variety. One of the largest of yellow peaches. Shape round, skin ; deep yellow with red cheek; flesh yellow with rich Crawford flavour; freestone. Ripens mid-season. One of the very best canning and drying peaches and excellent for desert. Not wanted for export. Does well on the high veld of the Orange Free State, Natal and the Transvaal, also the Western Province of the Cape.

Gladstone.—An English peach originated by Mr. Thomas Rivers. Size large to very large; shape round; skin greenish with red cheeks; flesh white, good flavour and texture; freestone. Ripens late. Does fairly well in the Western Province of the Cape and moderately so in the higher parts of the Union.

Hales Early.—A favourite American variety, largely grown in California, where it is the best peach of its class (Alexander). Size large to very large; shape round; skin green with full red cheek; flesh white, tender, melting and juicy with exquisite peach flavour; freestone. Ripens end December. Is one of the choicest dessert peaches and has been successfully exported. Suitable for the high

veld of the Orange Free State and Transvaal, Natal and also the Western Province of the Cape.

High's Early Canada.—One of the Alexander type, but it is a better peach. Size medium to large; shape round; skin greenish yellow with red colourings on exposed side; flesh white, tender, juicy and melting; freestone. Ripens with Hales Early. An excellent dessert peach and will export. Suitable for the high veld of the Transvaal, Orange Free State and Natal, also the Western Province of the Cape.

Improved Waldo or Improved Peen-to.—A Chinese type of peach, nothing like either Waldo or Peen-to in shape, but with similar flavour. Size medium; shape slightly flattened; skin cream with red blush; flesh white, juicy, tender, melting, slight noyau flavour; freestone. Ripens November–December. A good dessert variety. Has not been exported and is not recommended for that purpose. Will thrive in the Transvaal bush and low veld, Natal Midlands and coastal areas, Central and Eastern Province of the Cape. Like all peaches of the Chinese type, it is a very rapid grower.

Jewel.—The earliest of all the Peen-to family of a reliable nature, and valuable for that reason. Size medium; shape round with pointed "nose"; skin creamy with pink blush; flesh creamy-white, juicy and melting. Ripening depends on locality. Is marketed in October in the Transvaal. An excellent dessert variety, but of no use for anything else. Suitable for bush and low veld of the Transvaal and Natal coastal districts and the Eastern Province of the Cape.

The Inkoos.—South African's best production and the last word in peaches of the Alexander type, from which tree it is a bud sport, raised by Mr. H. O. Arton, of Packwood, Zuider Paarl, Cape. Size large; shape round; skin greenish-yellow, almost entirely covered with red blush; flesh white, juicy and melting. Free grower and heavy bearer. Unlike its parent does not drop its buds and the twigs do not die back. Ripens ten days earlier than Alexander. Will be the most sought after of early peaches. Is an excellent dessert variety and ripens early enough to catch the Christmas market in England. The best early export peach. Suitable for the high veld of the Transvaal and Orange Free State, Natal and the Western Province of the Cape.

Killiekrankie.—Peen-to type of peach. Size medium to large; shape roundish; skin yellow with red cheek; flesh tender and melting; freestone. Ripens after Jewel. A dessert peach only. Not an export variety. Will thrive in bush and low veld of the Transvaal, midlands and coast belt of Natal and certain areas of the Eastern Province of the Cape.

Late Crawford.—Similar to Early Crawford, but often grows to an even larger size and is rounder in shape; in fact, a better looking peach. Skin yellow with deep red cheek; flesh solid but tender, with

true Crawford flavour; freestone. Ripens February. Is a fine drying and canning, also dessert, variety. Not exported so far. Suitable for high veld of the Orange Free State and Transvaal and Natal, also the Western Province of the Cape.

Mamie Ross.—An American variety and a very popular one here. Size large to very large; shape roundish, inclined to be pointed; skin white with red cheek, very handsome; flesh white and juicy and of good flavour, a little coarse; half clingstone. A good grower and a regular bearer. Ripens January. Is a dessert peach of good quality; not first class for export. Thrives nearly everywhere throughout the Union.

Mary's Choice.—An American peach of the Crawford type. Size large; shape round, slightly elongated; skin yellow with deep red blush; flesh yellow, solid yet tender, with real Crawford flavour; freestone. Ripens, January–February. Is an excellent drying and canning peach; has not been exported. Suitable for the high veld of the Orange Free State, Transvaal and Natal, also the Western Province of the Cape.

Mayflower.—A good early peach introduced by the Agricultural Department from Australia in 1916. Size medium to large; shape round; skin greenish-yellow almost entirely covered with deep red, sometimes solid red; flesh white, tender and of good flavour. Should ripen late November or early December. Suitable for high veld of Transvaal, Orange Free State and highlands of Natal, also the Western Province of the Cape.

Mountain Rose.—An American peach introduced by the Transvaal Agricultural Department in 1903. Size large; shape round; skin white, with red blush; flesh white, tender, juicy and melting; freestone. Ripens end of January or early February, according to situation. An excellent dessert peach; not exported hitherto. Suitable for the high veld of the Orange Free State, Transvaal and Natal, also the Western Province of the Cape.

Muir.—A Californian seedling which does better in South Africa than its own country. Size large to very large; shape slightly elongated; skin clear yellow; flesh yellow to the stone, which is very small, and free. Flesh is tender, though of good flavour and solid. Ripens January–February. A very profitable variety for drying, giving $4\frac{1}{2}$ lb. of green to one of dried fruit. Cans fairly well. Is useless as an export peach. Suitable for high veld of Transvaal, Orange Free State and Natal, also the Western Province of the Cape.

Newhall.—Originated in the nursery of Mr. Newhall, near San Jose, California; a good peach of the Crawford type. Size large to very large; shape round; skin yellow with deep red cheek; flesh solid yet tender with real Crawford flavour; freestone. Ripens February. A first-class drying and canning peach; not suitable for export. Does fairly well on high veld of Transvaal,

Orange Free State and Natal, also the Western Province of the Cape.

Pallas.—One of the best of the Peen-to family. Size large; shape round with slightly elongated point; skin cream with red blush; flesh white, juicy and melting, tender with slight noyau flavour; stone free and very small. Ripens December–January. Is a dessert peach of good quality, but of no use for either drying, canning or export. Will thrive in the Transvaal bush and low veld, midlands of Natal and the Eastern Province of the Cape.

Peen-to or Flat Peach of China.—The oldest known variety of peach in China. Parent of a very large and prolific family, a feature of which is the very distinct flavour. Nearly all the seedlings of Peen-to are better than their parents. Size medium; shape flat with depression in centre, from which a spot of gum frequently oozes; skin green with slight red blush in the sun; flesh tender, juicy and aromatic; free and very small stone. Ripens December. Useless for anything but dessert; is a garden rather than an orchard variety. Suitable for bush and low veld of the Transvaal, midland and coastal districts of Natal, and the Eastern Province of the Cape.

Peregrine.—A good peach of the Alexander type, of English origin. Size large; shape round; skin green, almost entirely covered with red; flesh white, tender, juicy, melting, real English peach flavour; freestone. Ripens January. A dessert and export peach of the best quality. Suitable for the high veld of the Transvaal, Orange Free State and Natal, also the Western Province of the Cape.

Pucelle de Malines.—Another peach of similar type to the last mentioned, but later. Size medium to large, shape round; skin greenish-yellow, with deep red blush on side exposed to the sun; flesh white, juicy, melting and of fine flavour; freestone. Ripens January–February. A good dessert and export peach. Suitable for the high veld of the Transvaal, Orange Free State and Natal, also the Western Province of the Cape.

Royal George.—A well-known Old English variety of large size and round in shape. Skin pale greenish-yellow, marbled with pink and red on the side next the sun; flesh creamy white, juicy and tender, of delicious flavour, red at stone. Ripens late, January and February. A first-class dessert peach. Has not been largely exported. Will grow down to 3500 feet in the Transvaal and Natal, also in the Western Province of the Cape.

Salway.—A well-known Old English variety, regular and a very heavy bearer. Size large to very large; shape round with small point; skin yellow with deep red cheek; flesh yellow and firm, of good flavour; red at pit, which is free. The latest of all good peaches. Is an excellent canning and drying peach. Not usually exported. Suitable for the high veld of the Transvaal, Orange Free State and Natal, also the Western Province of the Cape.

Shackleford.—One of the Peen-to family. Size large; shape round; skin greenish with red cheek; flesh white, juicy, tender and melting; freestone. Ripens mid-December or later. A dessert peach not suitable for export. Will thrive in the bush and low veld of the Transvaal midlands and coastal districts of Natal and Eastern Province of the Cape.

Shanghai.—Is one of the Chinese cling family. Size large to very large; shape roundish, elongated; skin clear yellow; flesh yellow, firm and solid, of attractive flavour; red at stone. Ripens February and March. A drying and canning peach. Suitable for bush veld of Transvaal and midlands of Natal.

Vaal Mammoth.—A very large type of a common yellow peach of South Africa. Size large to very large; shape round with small point; skin clear yellow, withered cheek and red at the stone; flesh yellow and firm; freestone; also cling strain to be had. Ripens February. An excellent canning variety. Suitable for all parts of South Africa except the Western Province of the Cape.

Victor or Le Vainquer.—Introduced by the Transvaal Agricultural Department; and Alexander type of peach; said to have originated in the Crimea. Size medium to large; shape round; skin greenish with red blush; flesh white, juicy and melting; freestone. Ripens before Alexander, sometimes ten days earlier. Purely a dessert and export peach. Suitable for high veld of the Orange Free State, Transvaal, Natal, also the Western Province of the Cape.

Waldo.—A seedling of the Peen-to. Size medium, getting smaller as the tree attains age and overbears, to which practice it is badly addicted; must always be heavily thinned; shape elongated and pointed; skin creamy with red blush; flesh white, juicy, tender and melting, noyau flavour; freestone. Ripens after Peen-to, December–January. A nice dessert peach, but useless for anything else. Suitable for bush and low veld of the Transvaal and Natal and the Eastern Province of the Cape.

Waterloo.—A peach of the Alexander type. Size large to very large; shape round; skin red to dark red; flesh white, juicy, tender, melting; half clingstone. Ripens about same time as Alexander. Is a fine dessert and a good export peach. Suitable for high veld of Transvaal, Orange Free State and Natal, also the Western Province of the Cape.

Wonderful.—An Australian favourite peach; introduced to Natal by D. A. English and Co. Size large to very large; shape round; skin yellow with deep red cheek; flesh yellow and juicy, yet firm; freestone. Ripens February–March. Suitable for bush veld of Transvaal and midlands of Natal, also the Eastern Province of the Cape.

Wiggins.—An Alexander type of peach. Size large to very large; shape round; skin greenish-yellow, almost covered with

red blush; flesh white, juicy, tender; freestone. Ripens just after Alexander. An excellent dessert peach and should export satisfactorily. Suitable for high veld of the Orange Free State, Transvaal and Natal, also for the Western Province of the Cape.

Clingstones for Canning

Lemon Cling.—An American variety, formerly a great favourite as a canning peach. Size large to very large; shape elongated and pointed; skin yellow and clear; flesh yellow, juicy yet firm. Ripens March. Suitable for high veld of the Orange Free State, Transvaal and Natal, also the Western Province of the Cape. Not regarded as a particularly reliable bearer.

Nooiens Persike.—This is a favourite old Transvaal variety and a strikingly handsome peach. Size large to very large; shape round; colour yellow with red cheek; flesh firm yet juicy; clingstone. Ripens in February. Succeeds best in Transvaal and Natal bush veld.

Orange Cling.—Of American origin. Size large to very large; shape round; skin deep yellow with red cheek; flesh yellow and firm, delicious flavour. Ripens February. Suitable for the high veld of the Orange Free State, Transvaal and Natal, also the Western Province of the Cape.

Pullars Cling.—A very popular Australian peach of large size and excellent flavour. Skin yellow with red cheeks; flesh yellow, firm and solid. Is a canning peach pure and simple. Little grown in South Africa. It is claimed to be a good and regular bearer.

St. Helena Peach.—The common yellow peach of South Africa—too well known to require much description. One of the best of all canning peaches with less waste than any other variety. Exceedingly thin skin and very small stone, and has been more extensively planted in South Africa on a commercial scale than any other for canning purposes. Ripens February–March.

Sellers Cling.—One of the handsomest of all peaches but a shy bearer. Size large to very large; shape round; skin rich yellow with deep red cheek; flesh yellow, firm and solid, fine rich flavour. Ripens February–March. May be planted anywhere except on the low veld.

Tuscan Cling.—At present the most fashionable peach in California, where it is being planted largely for canning purposes.

Ceylon Blood Peach, April Persike, Blood Peach.—A red-fleshed peach from Ceylon originally. The only one of its kind, and is of little value except that it comes when there are no other peaches. Sells on local markets at fair prices. Ripe in April. Will grow almost anywhere, but is best at altitudes under 4000 feet.

Flowering Peaches.—These are purely ornamental trees and

although fruit does set on them occasionally, it is of little value. They make a beautiful show during the early spring months with their white and crimson blossoms. There is also a crimson and white striped one. They come from China and are still sold there in the streets of the northern towns by itinerant hawkers when the trees are in blossom. They are propagated in precisely the same way as the ordinary peach.

The Nectarine

This fruit attains perfection in the Western Province of the Cape, the high veld of the Transvaal, of the Orange Free State and Natal. Few varieties succeed in the hotter portions of the country. In the lower altitudes, where almost tropical conditions prevail, the nectarine may be said to be out of its range, for most of the best varieties of this fruit are those originated in England or other countries of the temperate zone. For commercial purposes in South Africa, the nectarine is valueless outside the local and export demands. It is not classed here as either a drying or a canning fruit. It does not seem likely that these conditions will alter, as the peach seems to meet all requirements both in the way of the canned and dried article, along these lines. The nectarine is both canned and dried to a very small extent in America and Australia, but even in these countries the output of either product is practically negligible. It is only since the Boston (which, by the way, was raised in America from a peach stone) and one or two other yellow-fleshed kinds became fashionable that the drying or canning of nectarines was thought of. Fashion, or long-continued custom, has enacted that the bulk of all peaches and nectarines used for these purposes must have yellow flesh, and because all our interest in South Africa is centred in local and export markets, hardly any yellow-fleshed nectarines are grown here. The Transvaal Agricultural Department introduced the Boston yellow-fleshed about 1905, but it was not appreciated either by the public or by nurserymen and propagation of that variety has in consequence ceased.

As the local consumption of nectarines is only of limited extent, and the bulk of those we do produce goes to England, it is only natural that the varieties most acceptable and highly thought of there should receive priority of consideration from the viewpoint of our growers. That this has been done goes without saying and every endeavour has been made, not to make the English market take what we want to dispose of to them, but to supply their actual requirements as nearly as possible.

Notwithstanding all the efforts made to give our customers exactly what they want, and to produce larger nectarines by means of every known and unknown artifice, by enriching the soil, by very careful

attention to all the details of pruning, by the use of irrigation water, etc., and the fact that we do supply that fruit up to $7\frac{1}{2}$ inches in circumference, the cry is still insistent for larger nectarines. It is unfortunate that the nectarine does not naturally attain the size of most of the peaches we send over—the only thing to do is to continue to endeavour to get larger and still larger nectarines, in the hope that eventually we may succeed in providing the article required.

Meantime a good and profitable business is being slowly built up. Statistics show a considerable increase in the number of trees planted throughout the Union, but as the total number is under 100,000 it is evident that there is still room for more.

Most writers declare that the nectarine is really nothing else but a smooth-skinned peach. When it made its debut and took the name of nectarine is not quite clear. At rare intervals a peach tree will produce a nectarine or nectarines on one branch, such mutations are called generally " sports," due to bud variation or some other cause. It is also stated, though the author has no personal experience on this point, that nectarine seeds have produced peach trees, and *vice versa*. Be that as it may, the fact remains that the trees are identical in type, have the same habit of growth, they bear in the same way and require the same treatment in every particular.

Soil suitable for the peach is suitable for the nectarine, though some modifications may exist in this particular, should the latter be worked on any other than peach roots. The peach is the stock in general use here for the nectarine. In America and particularly in California the almond is more or less resorted to; in fact unprofitable almond orchards have been worked over to nectarines in that State.

Pruning systems applicable to the peach are equally adapted to the nectarine. It is possible that in this particular instance the Cape system of few branches and a hollow-shaped tree may prove of very considerable use in the endeavour to attain size in the nectarine.

The varieties of nectarines grown here are but few, yet—when they attain size—it appears likely they will prove equal to all demands. The fact that our only outlet, in bulk, is the export market, restricts our product to the varieties best adapted to that particular business. This, after all, is rather satisfactory. Should at any future time any considerable demand arise for yellow-fleshed nectarines, it will be an easy matter to supply them.

There are no large nectarine orchards in South Africa. The district of Paarl, C.P., has the distinction of producing more of this fruit than any other in the Union.

It is an open question whether the growth of the nectarine will ever develop to any large extent. Most writers on the subject state that the nectarine is a nice fruit and so on, and that plantings should increase. It does not, however, appear that it will ever equal the peach in popular favour either fresh, dried or canned, and

under such circumstances it is not likely that the nectarine will ever be planted in blocks of over 1000 trees in South Africa. Further, it is conceivable that a greatly increased supply might not (as is nearly always the case in the fruit business) increase the demand, nor yet the price.

The varieties in favour here are as follows. All of them may be successfully grown in the Western Province of the Cape and on the high veld of the Transvaal and Natal. Goldmine is the most successful as far as the bush veld of the Transvaal is concerned.

Albert Victor.—An English variety, size large, shape oval, flattened at apex, skin green with red blush, flesh greenish-yellow, juicy and melting, red next stone which is free. Ripens February. A good export variety.

Cardinal.—Size medium, shape roundish to oval, skin bright carmine, flesh white and tender. Ripens early, about end of December. Good for export.

Cousa or De Co Usa. Comes from America, is of good size, shape round, skin red, flesh white, tender and melting. Ripens after Goldmine. A favourite variety for export.

Early Rivers.—An English variety, large size, shape round, skin yellow with red mottling and deep red on the side next the sun, flesh juicy, tender and very rich. Ripens early in January and is the best early export nectarine.

Goldmine.—Originated in New Zealand and has done well in South Africa. Size medium, shape roundish oval, skin cream colour almost entirely covered with red, flesh juicy, tender and of delicious flavour, freestone. Ripens mid-January. It is a favourite export nectarine.

Lord Napier.—A popular English variety. Size large, shape roundish oval, skin cream with many red streaks, flesh juicy, tender and with similar flavour to Stanwick, freestone. Ripens about same time as Early Rivers. Will export.

New Boy.—An introduction from Australia with a good reputation. Size large, shape roundish, skin brilliant carmine, flesh white, sweet and juicy. Ripens February. Has not been exported hitherto.

Stanwick.—One of the most popular English varieties, said to have grown from seed brought from Syria. Size large, shape roundish oval, skin light green in shade turning to deep red on the sunny side, flesh white, juicy, tender, with a flavour supposed to be the best of all nectarines. Ripens late in February. One of the best export varieties.

Victoria.—Another English variety. Size large, shape roundish oval, skin light green with a red cheek on the sunny side, flesh white, juicy, tender and melting. Ripens end of January. Can be exported.

CHAPTER XVI

THE PEAR

The pear was amongst the earliest introductions of our fruit trees. There is no doubt but that it arrived here the same time as the apple and was brought by Van Riebeek. Quite a number of good varieties were found at the Cape by Mr. H. E. V. Pickstone on his arrival there at the commencement of what may be termed the " renaissance " period of fruit growing in that Province.

Although the pear tree, under favourable conditions, is the longest lived of all deciduous fruit trees, it is hardly possible that any of the original importations survived at that time.

The tree in South Africa has not, however, always grown under the most favourable conditions, yet it is so hardy that one may occasionally still find big pear trees surviving in what was once an orchard, when all the other trees have succumbed to the combined effects of neglect and age. These trees more resemble oaks than the present-day conception of a pear tree, such as may be found in the commercial orchards of the fruit-growing district, all trained to assume a certain shape, which is supposed to be symmetrical and to produce a certain quantity of fruit annually.

Although the pear is more extensively grown in the Western Province of the Cape than in any other part of South Africa, the author has seen many magnificent specimens in Natal and the Transvaal. Trees 2 feet to 2 feet 6 inches in diameter, 3 feet from the ground, have been noted at Klerksdorp (Transvaal) as well as in Drakenstein, C.P. These were indeed giants.

The types of pear grown principally are of European and largely of French origin, indeed the Dutch expression, " Frans Peer " so frequently used at the Cape, originally covered all really good pears. They were just " Frans Peeren." All belonged to the *Pyrus communis* family. This is mentioned in order to draw a distinctive line between that and the Serotina or Sand Pear type, which is of more recent introduction and to which the Keiffer, Le Conte, Hawaii and a few others are related.

The pear is very extensively planted at the Cape and has been exported in greater quantities than any other fruit. The pear export has in some years even exceeded that of the grape.

Commercial orchards are numerous and are to be found in most of

the districts which go to make up the Western Province of the Cape.

Unlike the apple, the pear has, from the earliest stages of the export business, been regarded as being one of the most profitable of export fruits. Practically all the pioneer fruit growers who set out the trees on the Rhodes Fruit Farms planted fully half the available land to pears. It was recognised that the pear was not only a good export fruit, but also found a good demand locally as fresh fruit, and was a first-class canning and drying article in addition.

Further, the proximity of the principal pear-growing districts to the port of Cape Town gave growers the assurance of a short railway journey, with small charges, to the boat and quick transport to the European markets. Perhaps the primary consideration which led to the planting of so many pear orchards was the fact that the pears produced in the Western Province were as fine, or perhaps finer and of better flavour, than most obtainable elsewhere; in other words, some of the best pears in the world were to be found at the Cape. Results have confirmed this opinion, for Cape pears are known all over England and in Europe and America. The varieties grown are confined to comparatively few. As with the apple, the most saleable kinds are most widely planted, and so one finds large numbers of the Keiffer variety, which cannot compare with any of the European varieties for quality, largely planted, not only at the Cape, but all over South Africa. Natal has many thousands of these and they are grown because they are extremely heavy and regular bearers and the fruit, when properly handled, is not by any means bad. It is somewhat of a favourite canning pear and is used for that purpose in large quantities, and always finds a market.

Districts for the Pear.—The pear is most extensively planted in the Western Province of the Cape. It also does well in many portions of the Transvaal, the eastern portion of the Orange Free State, Natal and a few parts of the Eastern Province of the Cape.

The districts of Paarl, Stellenbosch, Ceres and Worcester are held to be amongst the best in the Cape for pear growing. Pietermaritzburg and district (Natal) also produce large quantities of pears, principally of Asiatic type. The conquered territory in the Orange Free State, in the neighbourhood of Clocolan and Ficksburg, produces excellent pears and the same may be said of the whole of the high veld—both in the Orange Free State and the Transvaal. Here, however, the consideration of hail comes in, and, largely on that account, few pears are planted on the high veld. Experience at Ermelo (Transvaal) Experimental Station demonstrated that, given a season free from hail, the pears produced there were of really high quality. All the best European sorts succeeded admirably and this is equally true in the case of the Pretoria and Witwatersrand districts; in fact, down to 4000 feet

altitude. At a lower level than that in the northern portion of the Union the Asiatic types alone can be depended upon as regular bearers. At the Cape the altitude at which the best pears are produced runs from 400 to 800 feet. The difference in latitude is answerable for this.

The Agricultural Census of 1921, the latest available, states the number of pear trees in the Union to be:

	Bearing.	Non-bearing.
Cape	321,750	219,630
Natal	22,930	9,880
Transvaal	74,640	70,700
Orange Free State	87,020	31,340
	506,340	331,550

Situation and Exposure.—The best pear trees, *i.e.*, the healthiest, largest, best bearing, are to be found on level plain lands and in sheltered valleys. Although the tree will grow on a hillside, it is a very rare occurrence to see a pear orchard in such a situation. The nearer rail and port facilities are, the more development one finds in pear growing.

Whilst the pear thrives in the cooler parts of the country, it appears to be equally at home in the hotter districts and appreciates a northern and eastern exposure, where it can catch the first gleams of the morning sun. Colour in the pear is dependent largely on sun exposure and its effects are easily manifest in the lovely crimson cheeks many of our popular varieties possess.

For instance, Doyenné de Comice, Forelle, Josephine de Malines, Louise Bonne de Jersey and sometimes Bon Chrétien have a nice tinge of colour.

Shelter from high winds is one of the utmost importance at all times, but more particularly is necessary in the coastal valleys of the Western Province, where the south-eastern winds sweep over hill and dale with terrific violence during certain months of the year. It is perhaps only when damage from these winds happens that the advantages of shelter are fully appreciated. The months when these winds occur happen to be those when the fruit is on the trees, viz. December, January and February.

The selection of a site for the pear orchard must be made with certain points borne prominently in mind. They are:—

1. Position sheltered from high winds.
2. Suitable soil.
3. Proximity to transport facilities.
4. Avoidance of frosty situations.

The last-mentioned rarely calls for consideration near the coast, but further inland, damage from frost in not unknown.

The earliest pears are produced in the Transvaal and the Orange Free State. Bon Chrétien and Clapp's Favourite are ready to ship from ten days to two weeks before Cape fruit of the same varieties is ready. It appears that more interest in the pear business in the northern parts of the Union would not be unremunerative.

One reason why extended planting of the pear is not making the progress it should is the fact that the tree takes longer to come into bearing than any other kind of fruit tree. The Keiffer bears at an earlier age than any other variety, and that may account for the large numbers of this pear which have been planted recently. A small crop, when the trees are four or five years old, may be looked for. Bon Chrétien rarely gives anything of a crop before it is six years old.

Some of the valuable dessert pears, as Doyenné de Comice, do not seriously consider bearing before they attain the age of ten or twelve years. The author knew an orchard of Glout Morceau and Easter Beurré Peats in the celebrated Santa Clara Valley in California which only began to bear when the trees were fourteen years of age.

Soils for the Pear.—South African experience has shown that the soils in which the pear does best are to be found in the alluvial river-bank deposits. These may not always be as deep as is considered desirable, but the tree appreciates its surroundings when planted in the usual brown or grey, often approaching black, loams which are to be found in such situations. On the deep silt soils of the Karroo, some very fine pear trees are to be found, there is no end to the depth of soil there; it is soft and easily permeable to the roots.

Soils which contain an amount of clay which would be fatal to any other kind of fruit tree seem to affect the pear more beneficially than otherwise, and where analysis shows a fair amount of lime the tree does still better.

Light, sandy soils are not regarded as being desirable and one finds very few pear orchards planted on that class of soil. Karroo soils, as is well known, are often brack, yet the pear tree will flourish in them also. It is, in fact, a most accommodating and hardy tree.

Moisture in excess is not desirable, yet the pear will thrive in a soil sufficiently wet as to afford no hopes of an apple growing in it. The tree really requires a soil which is damp, but not wet. Some of the largest pear trees in the country are to be seen on black loams. The class of black soil known as "Turf" can scarcely be called suitable for the pear, yet even on these one may find fine old pear trees; the survival of a period when fruit growing as a business,

A GOOD TYPE OF BON CHRÉTIEN PEAR TREE.

with a complete knowledge of what trees to plant and the right soil to plant them in, was not as fully understood as it now is.

Although the pear undoubtedly prefers soils which are on the damp side, many trees are to be found which have grown and flourished under conditions of quite an arid nature. Because such trees exist, it must not be thought for a moment that they indicate a state of affairs under which the fruit may be grown commercially.

The pear tree requires good treatment if the best results are to be obtained, and in this respect resembles most other kinds of fruit trees in that the better they are treated, the more bountifully they respond. It may safely be assumed that any moderately good valley soil, with some clay and a little lime in its composition, having a minimum depth of 5 to 6 feet, though the deeper the better, will be suitable, other features being acceptable, for the profitable growth of the pear.

Rainfall and Water Supply.—Irrigation of the pear is rarely resorted to in South Africa. There is indeed, in our principal pear-growing districts, a sufficient, and occasionally more than sufficient rainfall, thus rendering irrigation by artificial means unnecessary.

Somewhere around 30 inches may be reckoned about the right amount of rainfall for the production of good-sized, luscious, fully flavoured fruit. Any very considerable increase above this quantity would lead to the production of abnormally large fruit of impaired flavour; whilst, on the other hand, a total rainfall of 20 inches without any additional supply would lead to small-sized fruit very likely lacking in flavour and of tough texture.

Yet the judicious application of irrigation water may be profitable, as well as good for the trees, and for these reasons it is well to have a supply to fall back on in case of need. Rains, especially in the north and east, do not always start as early in the season as many growers consider desirable, and the application of a little water helps matters then. During blossoming time the trees appreciate it and as a consequence of irrigation at that time it often happens that a bigger crop of fruit is set.

Then, again, an irrigation at the right time may accelerate or delay the time of ripening of the crop. The best of the earlier pears are Clapp's Favourite and Bon Chrétien, and to get these on to the market a week earlier than others or than is customary may mean a largely increased return. In order to get this extra early ripening, a watering in mid-growing season will often prove efficacious.

Irrigation will also delay the ripening of some of the later varieties of pears, which, as a rule, are not fit for picking before March. It is a question whether or not it is worth while to resort to this; previous to the general provision of cold storage, the possibility of

lengthening the season of certain varieties of late pears was decidedly worth considering, but now that the placing of fruit in cold storage has become general the necessity does not exist to anything like the same extent. However, not all pear growers can avail themselves of cold storage facilities and they may feel inclined to delay the ripening of their crops for the sake of possible better markets. The fruit ripens during the growing period of the tree's life. Early in the spring, the growth is fairly rapid, but as the season advances a certain amount of the vitality of the tree is absorbed by the fruit and, as a result, branch growth suffers. Water, during the hotter period of the year, say the end of January to mid-February, causes the branch growth to increase and delays the development of size in the fruit. This is, however, merely a temporary halt, for fruit so watered is not only later but larger than when no water is given.

Broadly speaking, irrigation of the pear may be regarded as desirable in those parts of the country which have summer rains, whilst, where precipitation occurs in winter, irrigation is largely unnecessary.

Propagation of the Pear Tree has been mainly confined to the budding of the desired varieties on to pear seedlings, and these have in the past been largely imported from France. The practice is still continued, though efforts have been made to put an end to the necessity of being dependent on Europe for our pear stocks, and not without some measure of success.

For many years it was considered out of the question to attempt to raise young seedlings from pear pips, yet this is now successfully done. The practice is to soak the seed for a certain time before planting. Seed is sometimes soaked for a week in cold water, or for a few hours in hot water, and this treatment enables it to germinate readily. Previous attempts with locally grown seed had been fairly successful. The seed was planted freshly taken from the fruit, but nearly all attempts to germinate imported seed had failed owing to its coming to hand in a dry condition. No reason exists now why all the pear stocks we need should not be grown in South Africa.

The question arises as to what variety of pear is best to use as a parent stock, and although success has been achieved with a few varieties, there is so far no particular sort to which resort is general for seed purposes. There is no question but that the pear, as a tree, thrives better in South Africa on its own roots than on any other. It was customary, prior to the introduction of modern nursery methods, to utilise the suckers or shoots which are sometimes found growing in abundance round old trees as stocks on which to bud or graft other varieties. This practice cannot be too strongly condemned. It is an unnatural method of propagation,

and results, in a large majority of cases, in the growth of a liberal crop of suckers round the stems of the trees so produced whilst they are still young. Those who plant suckers will grow suckers.

Whilst the pear may be grafted or budded on apple stocks, there is no advantage to be gained by so doing. As a rule trees grown in this way flourish for a time, but rarely have a long life. In England and North America pears are occasionally worked on thorn trees (not mimosas), medlars and mountain ash. With us in the Union of South Africa there is no object to be attained by going outside the ordinary practice of using pear seedlings as stocks, unless indeed it were for the purpose of providing dwarf trees for domestic gardens.

The use of dwarf trees for this purpose is justified, as it enables a larger number of varieties to be grown in a small space than would be possible were standard trees planted. It is doubtful if any nurseryman in South Africa stocks dwarf trees. There are no dwarf orchards here and but few in California. One prominent pear grower, Mr. A. Block, of Santa Clara, used to tell the author that he swore by the dwarf pear for the following reasons:

1. Being small compact trees, they were not liable to lose their fruit from high winds.
2. They bore heavily and regularly.
3. The crops were easily, quickly and cheaply picked, no time lost in hauling long ladders round.
4. They bore just as much fruit per acre as larger trees.
5. They were easier to prune.

These trees were planted about 1892, and at the time of writing, 1924, many are still standing, though they have been thinned out by degrees as they became too crowded. They were originally planted at a distance of 8 feet apart, protected from winds by a fine hedge of osage orange and cultivation was carried on by ponies about the size of a donkey.

Formerly the Angers quince was considered the best to use for grafting the pear, but now in this country where all trees grow so freely, almost any free growing quince may be used for a stock for the pear. Some of our vigorous quince hedges are quite capable of providing excellent fruit for seed purposes. Quince trees may also be grown from cuttings, but those from seed are preferable.

Comparatively few good class dessert pears will grow when budded directly on quince stocks. There are some, however, which appear to have an affinity for the quince, and so it is customary to bud one of these kinds on the quince stock and after that has grown for a season to rebud on to that with the variety desired. This is called "double working."

Of the sorts which take kindly to quince root, perhaps the Beurré Hardy is best of all, and has been most successfully used by the author. Notwithstanding double working, there are still some few varieties which do not appear to be at home on quince roots. It is claimed in England that pears worked on quince roots are superior in flavour to those of the same variety when budded on pear roots. In California it is said that the quince root is useful because it is resistant to the attacks of blight. Fortunately we do not suffer from that trouble here (yet) and the flavour of our pears on pear roots appears to be fully equal to that of any others. For the present, then, the quince may be regarded as outside the scope of the commercial pear grower in South Africa. It is possible, as time goes on, and more attention is devoted to the question of stocks for the pear, that some variety will be found to lend itself more especially to the production of good standard, healthy, vigorous, blight-resistant trees. We may not always be free from that curse of the Californian pear grower, blight, and shall perhaps be compelled to take action. Much attention has been and is being given now to that subject in California, and there are indications that in the Surprise variety recently introduced such a stock has been found.

Propagation is usually conducted by means of budding and the chapter on that subject should be studied. The practice of grafting the pear has died out as completely as it has in the case of most fruits.

Planting Pear Orchards.—In the largest pear orchards at the Cape, set out originally for Mr. C. J. Rhodes, the trees were planted at a distance of 20 feet apart in squares and in the centre of each square some quick-growing and bearing tree was put, in order that some cash returns might be assured during the period in which the pear trees would be unproductive. As a rule some kind of Japanese plum or peach filled the position excellently, bearing crops of fruit in the third year. This class of planting is termed "Quincunx."

Considering that the pear is such a large-growing and long-lived tree under ordinary circumstances, it seems desirable that a space of at least 24 feet should be given between each tree, and in the case of some free-growing varieties, even 30 feet would not be too great a distance. The trees are best planted in squares. Dwarf trees may be planted 12 feet apart.

The question of pollination is an important one and should not be lost sight of in the selection of varieties to plant. The time of blossoming should be taken into consideration, although the whole matter is not as important as in the case of the apple.

The sterility of certain varieties may be traced to conditions other than lack of pollination, but that pollination is necessary for

the regular cropping of the Keiffer pear is a recognised fact. The interplanting of Le Conte in an orchard of Keiffers at the rate of one Le Conte to about sixteen of the others will ensure regular crops of the latter variety.

It is a question whether there is any other variety of pear in South Africa which is self-sterile from a lack of pollination. In any case, it is highly advisable to plant out all pear orchards so as to have alternating varieties every six rows. If this is done, there is small cause to fear that crops will fail from non-pollination. The most popular varieties are amongst the following:—

Bon Chrétien.	Clapp's Favourite.	Glout Morceau.
Beurré Bosc.	Doyenné de Comice.	Keiffer.
Beurré Superfine.	Duchesse d'Angoulême.	Louise Bonne de Jersey.
Beurré Hardy.	Forelle.	Winter Nelis.
	Josephine de Malines.	

Amongst these it is probable that Bon Chrétien is the most widely planted. It is a favourite for local markets, export, canning and drying purposes. A recent publication by the Berkeley (Cal.) Experiment Station says that the Winter Nelis has proved the best fertiliser for Bon Chrétien in that State; Comice, Bosc and Beurré Hardy were also good. It also recommends one hive of bees for each acre of pear orchards for pollinating purposes.

Pruning.—Pear trees are pruned in South Africa principally on what may be called the " vase " system, as opposed to the centre stem system. The reason for this in the Western Province is clear, for by this means the fruit which growers there require most is obtained. The demand is for fine large fruit for export and this is produced on the outside branches of the tree, and for that reason the inner ones are most of them cut out in order that all the strength of the tree should be concentrated in the outer ones, the continuation of these in an upright direction is allowed every year by selecting the strongest and best for the purpose.

The ultimate shape attained by trees pruned in this way will depend largely on the variety. Keiffer and Bon Chrétien are naturally very upright growers, whilst others, such as Winter Nelis have quite a different habit of growth. Indeed, the latter is a phenomenal tree and the one pear which it is wise to leave severely alone after the first four years of its life. An occasional branch may require removal, otherwise this variety bears best without pruning. It is not unusual to see pear trees which have been neglected in the matter of pruning assume a shape which, whilst not by any means symmetrical, is not without merit as far as quantity of fruit is concerned. The branches may grow straight upwards until such a time as a heavy crop weighs them down, then they remain in a horizontal position. At intervals of about a

foot or so along these limbs, new growths are put out which have a directly upward tendency. They bear a very heavy crop annually, usually so heavy that all the fruit is small. Trees such as these are not seen in our best pear districts. What is wanted for our most important and profitable export trade is quality and not quantity. The chapter on pruning indicates the methods by which the branches may be trained to grow in the desired direction, and if these are followed, it will be found a comparatively easy matter to get a pear tree to grow as it is desired. So many varieties are during their early years of an extremely upright habit of growth, and up to the time when they reach the age of eight or nine years it may be said that it is a sound proposition to cut to an outside bud at each annual pruning.

All pear trees should be headed low so that the stems of the trees may be shaded from the hot rays of the afternoon sun. Eighteen to 20 inches is about the right height, then care must be taken *not* to open out the head of the tree to such an extent that insufficient protection is afforded by the leaves to the branches. The pear is particularly subject to sunburn, in fact, that is the cause of more trouble than anything else in the culture of the pear in South Africa.

Non-pruning of the pear in its early growth leaves long branches only scantily covered with leaves, and it is under such conditions that many pear trees are ruined. The bark dries up, cracks and may be pulled off quite easily with the fingers. Then the tree languishes and dies. It is not uncommon to see old pear trees half dead from this cause. The side exposed to the afternoon sun is always the first to go.

There is a good deal to be said in favour of the "centre stem system" of pruning the pear. It is a very easy matter to train trees to grow in this manner, and the main stem or trunk is always covered and protected from sun-scald by the lateral branches. The tree assumes a nice symmetrical pyramidal appearance and there is always plenty of bearing wood on it. It is necessary to make up one's mind thoroughly beforehand as to what system of training is to be adopted before the first pruning of the trees is done after planting. If the centre stem system is decided on, then a strong upright branch in the centre of the tree must be kept and treated as a leader, made to grow straight up by cutting one year to an inside bud and the next to an outside one. As a rule there is no lack of lateral branches and these must be allowed to grow at intervals, but not in too great numbers.

Probably the vase-shaped, hollow-centred tree will grow the finest and the centre-stemmed tree the most fruit.

Thinning the pear is little practised in South Africa. There may be occasions when the work is justifiable, but most growers leave

it alone. The object to be attained in thinning is to relieve the tree and prevent any damage from overbearing, and also to encourage the specimens which are left to attain larger size. As a rule, the pear is a generous bearer, often apt to overbear, and it is a common sight to see the branches of the trees propped up to prevent them breaking with the weight of fruit. Most of our growers would prefer that to happen instead of not having to thin their fruit.

Cultivating and Fertilising.—Entirely different situations have to be faced in the cultivation and fertilisation of the pear in the fruit districts of the Western Province of the Cape and those existing in any other part of South Africa. The Western Province alone has a winter rainfall, whilst the other parts of the Union where pears are grown get summer rains. This remark of course applies to all other fruit, but affects the pear chiefly, and is therefore emphasised. Western Province conditions require, especially during the younger stages of the life of the tree, clean cultivation from the time the last ploughing has been done until February. During these months, the trees should do most of their growing, and they do not want anything likely to interfere with that. On the other hand, they need to be encouraged in every possible way. The turning under of a heavy weed crop at the close of the rains provides a good supply of humus and this assists the retention of moisture. Frequent cultivation maintains it (by frequent is meant a stirring of the ground at least once monthly) and helps in the provision of the requisite growing conditions. The planting of cover crops such as melilotus or cow peas should be resorted to. A cover crop should be regarded as a necessity.

As a rule, the addition of large quantities of stable manure to the soil is productive of excellent results, and the supply of phosphates, lime and potash should be studied. Ground bones make an excellent source of supply for the phosphates, whilst potash may be supplied best in the form of muriate of potash. The pear is a gross feeder and, as has been pointed out, a heavy bearer, and therefore soil fertility must be maintained if regular and prolific crops are to be looked for. The application of commercial fertilisers should take place in May or June.

In those parts having a summer rainfall soils are often better and deeper, and often the pear grower is a man of less experience than his compatriot at the Cape. He may fertilise his trees from the first year, to give them a good start. If dependent on rains as are most, and these should be late in coming, the season's growth is likely to be curtailed and so help by means of fertilisers is acceptable. Kraal manure, a basket to a tree, dug in at least 18 inches away from the stem, may be applied with advantage. The last

ploughing should take place about February or March and the land should be cultivated regularly until it rains again.

Commercial fertilisers should be given during November and December. The same constituents are required as at the Cape. As a rule, the ploughing under of a heavy crop of weeds with the possible addition of a leguminous cover crop should provide a sufficient supply of nitrogen. Fortunately, we in South Africa do not up to the present suffer as they do in California from pear blight, and so the application of large doses of fertilisers may be indulged in. It is considered that heavy wood growths are conducive to the spread of blight, and these are, of course, encouraged by much fertilising of the soil. Here we want the pear to hurry up and get to business at as early a date as possible, and for that reason we have to fall back on fertilising to as great an extent as the trees will be benefited by. A safe proportion for use on trees six years old is 300 lb. of ground bone and 100 lb. of muriate of potash, half that quantity for younger trees, and double for old trees. Nitrate of soda may be added if growth is very backward.

Harvesting the Pear Crop.—All depends on the purpose for which the fruit is required. The epicure, the amateur gardener and the professional gardener of the rich man will approach the question from two points. The stage of ripeness at which to gather different varieties of pears in order to secure:—

1. The development of the finest flavour.
2. The best period to secure long keeping.

These points are both lost if the pear is allowed to ripen on the tree. Fortunately, in a large number of cases, the two points mentioned fit in quite nicely. Development of flavour and keeping qualities may be secured at one and the same stage of ripeness, or rather unripeness.

It is a special study to know just when to pick a Beurré Superfin or a Doyenné de Comice. One thing is generally agreed upon, and that is, that after gathering, the fruit must be storéd in a cool, dark place. Pears must *not* be exposed to the air on the shelves of an ordinary fruit room; they may be placed in specially made drawers or a more simple practice is to store them in boxes. Exposure to the air causes some varieties to shrivel.

The time to pick is best decided, in the case of the Bon Chrétien, by lifting the fruit as it hangs vertically on the branch to a horizontal position. If the stem breaks, the fruit is ready to pluck. This does not, however, hold good in the case of the same pear for export purposes. As soon as the desired size is attained, it may be picked, and, moreover, if left to hang a very little too long, there is every probability of the Bon Chrétien ripening too quickly and

not arriving in the condition in which English buyers like to have them.

Ordinarily, when the pips begin to turn brown in colour, that is recognised as being an indication that the ripening processes are about to commence, and most varieties may then be gathered. Export of pears from South Africa is carried on under very favourable conditions. The fruit is picked, packed and placed in cold storage, and spends practically a month in that state before it is landed in England. With the exception of one or two varieties, pears so handled may be kept there for a month or more if necessary, before being exposed for sale, and during that period they improve in flavour. It may also be held over for improved markets, if prices are low.

Pears in Cold Storage.—The practice of placing pears in cold storage has been in use in South Africa, especially in the Western Province of the Cape, for a considerable time. The Cape Orchard Company were pioneers in this line. When they commenced operations the export of pears was on a small scale, and the benefits of cold storage and the higher prices obtained were largely from local business.

The advantages of cold storage for export pears have already been mentioned. The life of the fruit is prolonged and ripening retarded, whilst the flavour also improves.

Fruit for storage is best if placed in the ordinary export pear box; those not less than 6 inches deep are the best. They store usually at 32–33° Fahr. and at that temperature will remain in sound condition for three or more months, depending on the variety. On removal from storage, they require to be carefully handled and kept in as cool a place as possible. If exposed for sale in a shop or fruiterer's stand, they should be kept out of the sun.

Drying.—The drying of pears can be and is successfully carried out in South Africa by the direct rays of the sun. References to different methods will be found in the chapter on that subject. The variety which excels all others as a drying pear is the Bon Chrétien. Ordinary methods are practised and pears both peeled and unpeeled are a common sight in our shop windows. The South African dried pear compares favourably with the produce of any other country and is a favourite on the English market.

The production of dried pears on farms only, for the season ending in August, 1923, was 286,458 lb. This does not include the output of the large drying establishments of the Western Province, which was probably very largely in excess of those figures. It does, however, show that large numbers of pears are grown and dried on the farms and that the industry is one which may be carried on with success by the individual farmer as well as by the regular drying establishments. It should be borne in mind

that the final touches to a box of dried pears, to fit them for competitive market purposes, are better put on at any one of the latter places, where uniformity of pack, weight and general appearance of boxes can be better attended to.

Varieties.—Beurré Bosc. An old favourite variety, originated in Belgium, now grown everywhere. The fruit is an elongated pyriform in shape, medium to large in size, covered entirely with russet; flesh white and melting; tree a free grower and good bearer. A dessert pear of first quality, excellent for export and good keeper. Ripens in March.

Beurré Clairgeau.—A most attractive looking pear of pyriform shape, large to a very large size. Skin yellow, shading into bright red on side exposed to the sun; flesh sweet and watery; coarse. A second-rate pear grown for dessert purposes. Tree an upright and hardy grower and a heavy bearer. Not a favourite export variety. Keeps well and ripens in February.

Beurré Diel or Magnifique originated in Belgium and was formerly a great favourite, but is not now as extensively grown. Shape obtuse pyriform; size large to very large, occasionally weighing 1 lb. each; colour yellow, with russety dots, flavour excellent, sweet, with creamy white melting flesh. Tree is a vigorous grower, fair bearer. A dessert pear which keeps well. Ripens in March and later.

Beurré Hardy.—A favourite pear, both here and in England. Of true pyriform shape and medium to large in size; colour yellow, glossy with russety dots; flesh white, sugary, juicy and of delicious flavour. Tree is a free and upright grower and a heavy bearer. A dessert pear of good quality, one of the best export varieties and keeps well. Ripens February.

Beurré Superfin.—Fruit of obovate pyriform shape and medium to fairly large size; colour greenish-yellow but skin is nearly always covered with russet; flesh cream colour, of exquisite flavour and no signs of coarseness. Tree is not a vigorous grower and not a heavy bearer until it attains age. One of the best dessert pears. Travels well, but is not exported in large quantities. Ripens in March.

Bon Chrétien (*Bartlett* in *America*, *William's Bon Chrétien* in *England*, commonly called *William.*—The most popular and widely planted of all pears. Fruit perfect pyriform, of medium to large size; skin green, turning yellow when ripe and sometimes with a red cheek; flesh white, buttery, melting and juicy, with beautiful, perfumed flavour. Tree an upright, fairly quick grower, commencing to bear at about six years of age, sometimes sooner. A heavy bearer. Fruit must be picked green and house ripened. Is one of the choicest of all dessert pears and the best for canning

and drying purposes. A fair keeper and good export pear if properly handled. Ripens January.

Clapp's Favourite.—An American variety resembling Bon Chrétien but about ten days earlier. Shape pyriform, slightly obtuse; size medium to large; colour yellow with brown dots, and occasionally reddish cheek; flesh melting, sweet, vinous flavour. Tree a strong, upright grower. A dessert pear of good quality, not equal to Bon Chrétien, but valuable on account of its early ripening. Ships well and realises good prices. Ripens December to January.

Calabasse.—The largest of all pears, irregular pyriform in shape; colour dark green, almost completely covered with crimson blush. Tree a free and vigorous grower and fair bearer. The fruit is only fit for cooking purposes.

December.—The earliest pear we have and only of value on that account. Fruit small and true pyriform shape; colour green; flesh white with fairly good flavour when fully ripe. Tree an upright grower and fair bearer, not a keeping fruit. Ripens in December, hence its name here.

Doyenné de Comice.—Of French origin and considered by many to be the best of all pears for dessert purposes. Roundish to obtuse pyriform; size medium to large; colour green, turning to yellow with russety spots and crimson blush on side; flesh white, melting, juicy, rich and perfumed. Tree a strong grower, not an early bearer, but makes up for lost time when it attains age. One of the best pears for export, regularly bringing the highest prices. Excellent keeper. Ripens March and April.

Duchesse d'Angoulême.—Another French pear of fine quality. Large to very large in size, oblong, obovate shape, irregular, ridged and sometimes knobby; colour greenish-yellow, with russet spots and streaks. Not a very strong growing tree nor a very heavy bearer, but as a rule yields regular crops. A first-class dessert pear, keeps well and is well liked by the export trade. Ripens April.

Easter Beurré (France).—Large to very large in size; shape roundish, flattened at calyx end, obtuse obovate; colour green, with russet dots; flesh white, fine grained, melting, with rich flavour. Tree an upright grower and good bearer when it attains age, comes into bearing late. Too large to be considered a choice dessert pear. Stores and keeps well and is amongst the last to ripen being fit to pick in May, when it is too late to export, but is good for local markets. This pear is to be found all over the world and is a favourite in England.

Fertility.—A most prolific variety, raised by Mr. Rivers (England); of medium size; flesh half melting, juicy and sweet, with perfumed flavour; stalk $\frac{3}{4}$ to 1 inch long, and stout. Bears young. March and later. Will not store satisfactorily. (Pickstone's Catalogue.)

Flemish Beauty.—A dessert pear of Belgian origin. Of large size and irregular, obtuse shape; colour green with russet patches; gets yellow as it approaches ripeness; flesh buttery, melting, juicy and of good flavour. Tree is a good grower and fair bearer. Keeps and exports well. Ripens March.

Forelle.—A very pretty pear of medium size and longish pyriform in shape. Its colour is its chief attraction, being greenish-yellow, with bright carmine cheek and many brown spots. Flesh white, melting, juicy and aromatic. Tree upright, vigorous grower and good bearer. Needs protection from high winds, keeps well and is a good export sort. Ripens March and later.

Gansel's Bergamotte.—The most extensively planted pear of this type in South Africa. The fruit is of medium size, roundish and flattened ; colour largely russet, with red cheek next the sun; flesh white, somewhat gritty, but is juicy, rich, sweet, with musky perfume. A good dessert pear. Tree good grower and fair bearer. This variety keeps fairly well and may be profitably exported. Ripens in March.

Glout Morceau.—Originated in Belgium. Is of large to very large size; shape short, stocky, pyriform, with a decided neck, also short and obtuse; colour green, becoming yellowish as ripening stage approaches; flesh white and fine grained, rich, melting, tender and sweet. A good dessert pear, although not of very attractive appearance. Tree an upright, strong, though somewhat slow grower. Bears earlier here than in any other country. Fruit keeps well and is a good export variety. March and later.

Jargonelle.—One of the oldest pears in cultivation. Fruit slender, longish pyriform in shape; medium size; colour green, getting yellowish as it nears ripening period, with occasionally a brownish cheek; flesh cream colour, tender, melting and juicy and of rather a nice flavour. One of the best early dessert pears. Tree an upright strong grower. Fruit mealy if not house ripened, and will not store or export. Ripens December, January.

Josephine de Malines.—Fruit medium to large size; pyriform shape; colour yellow with green tinge and red cheek on side exposed to the sun; flesh cream colour, tinged with pink, of rich, juicy, melting, sweet and somewhat vinous flavour. A dessert pear of the best quality. Stores well and is an excellent shipper and favourite on the export market. Ripens March.

Keiffer.—One of the hardiest of pears. Will grow in the coldest as well as the hottest parts of the country and succeed in the latter where all other pears will fail. Requires to be cross-pollinated with Le Conte. The Keiffer is a hybrid of the Bon Chrétien and the Sand Pear. It originated in America with Peter Keiffer, a gardener of Roxborough, Philadelphia. First fruited in 1873. Shape

pyriform, somewhat irregular, often tapering to a point at calyx end; size large to very large; colour green, turning to yellow when ripe. Should always be house ripened. Flesh coarse-grained and gritty, sweet flavour, good for eating when properly ripened and makes a good canning pear. Tree very strong, upright, vigorous grower and (when properly pollinated) a heavy and regular bearer. One of the most profitable pears to plant. Stores well and can be exported, but is not a special favourite on that market. Ripens March and later.

Le Conte.—This is the first known cross between the Sand Pear of Asia and some unknown variety, originated in America about 1850 and is about as hardy as Keiffer. The two varieties should always be planted together. Shape, roundish pyriform; size small to medium; colour green, turning to yellow as maturity approaches; flesh less gritty than Keiffer and sweet. Not a first quality pear but a heavy bearer. Tree a fairly strong and upright grower. Is not a keeping or export pear. Ripens in February and later.

Louise Bonne de Jersey.—A favourite pear all over South Africa. Shape elongated pyriform and medium size; colour greenish-yellow with brownish-red cheek on sunny side; flesh white, juicy, melting and of delicious flavour. A dessert pear of exceptional quality. Tree a free grower, develops a fine large head and bears regularly heavy crops of fruit, mostly in clusters. Is an excellent keeper and good export variety. One of the best. Ripens March.

Marie Louise.—A very fine pear which succeeds in warm climates such as Cape midlands. Shape, oblong pyriform, medium to large size; colour green until ripening, when it takes on a yellow tinge; flesh white, delicious, melting, with sweet, vinous flavour. Tree strong grower, upright shape and a good bearer. Not a particularly good keeper and has not hitherto been exported. Ripens February.

Sweet Saffraan.—An old Dutch pear, well known all over South Africa, where the tree attains immense size. The fruit is also large to very large, true pyriform in shape; colour yellow when ripe; flesh tender, very juicy and sweet. A good eating pear. Tree vigorous spreading grower, does not bear too well and fruit will not keep. Ripens February.

Tongres (*Durandeau*).—An introduction of Messrs. Pickstone, who describe it as "an excellent variety and a heavy and early bearer." Tree takes a natural shape and is an upright grower. Fruit is a true pyriform, highly coloured on sunny side. Is not a good keeper. Ripens March and later.

Winter Nelis.—A very favourite pear and a great success in the Western Province, where it attains a size unknown elsewhere and

may be called a medium to large pear. Shape roundish obovate, thinning considerably towards the stem; colour green, covered with russet almost entirely; flesh cream colour, fine-grained, rich, melting and with a sweet aromatic flavour. An excellent dessert pear. Tree of very slender growth and is best unpruned after the shape has been determined. Fruit is a very fine keeper and does well for export. Is a favourite in Covent Garden. Ripens March.

Winter Saffraan.—A very large tree, similar to Sweet Saffraan, bearing large, obovate, pyriform fruit. Colour green, with a little russet. Is purely a cooking pear. Ripens March and April and will keep for months.

Packham's Triumph.—An Australian pear introduced in 1904 by the Transvaal Agricultural Department. Shape roundish, flattened, of medium to large size; colour green, almost covered with russet; flesh tender, fine-grained and of a delicious flavour. Tree a vigorous grower and good bearer. Fruit keeps well and is a good export variety. One of the favourite Australian export pears. Ripens in March.

CHAPTER XVII

PLUMS AND PRUNES

Although the commercial cultivation of the plum only dates from what has been called the "renaissance period" of South African fruit growing, there is evidence that this fruit was first brought to the country by the early Dutch settlers. Very few varieties survived, and those which did were either the Myrobolan or Cherry plum or some of the domestic type, such as Damask. It is only within recent years that the Japanese varieties of plums and their hybrids have been introduced, and it is, of course, easy to understand why they were not represented among the survivals of the early importations.

Among the types of plums we have in South Africa to-day are the Domestic, which includes the Prune, the Japanese and its hybrids, the Myrobolan or Cherry plums and the Simoni (Chinese).

For commercial purposes, the domestic class in South Africa, apart from the prune, counts for very little. They have very marked likes and dislikes as to soil, stocks and climate. In certain sections of the Western Province of the Cape they meet with moderate success. Portions of the Eastern Province in the higher and cooler altitudes also appear suitable. In the Transvaal, Orange Free State and Natal, the domestic plums rarely succeed under 4000 feet altitude and do much better at from 5000 to 6000 feet, where they experience, at any rate, some approach to their indigenous conditions.

The Japanese type of plum is, on the other hand, at home anywhere in South Africa. On the Rand, at an altitude of some 6000 feet, and right down to the coast line at close on sea level, some kinds of Japanese plums are to be found which will grow luxuriantly, fruit abundantly and thrive generally. Further, the fruit they produce is of a showy, attractive nature such as is calculated to catch the eye of the purchaser, and so, even if not as good a fruit as those of the domestic class, the demand for Japanese plums is good.

The Myrobolan plum and its now popular hybrids occupy the attention of growers to some considerable extent. Originally used largely and almost solely for the supply of stocks on which to bud other varieties, the appearance of a chance seedling Methley

brought the hybrid of Myrobolan into the limelight and they have proved quite a success. Probably this is due to a certain extent to the early ripening of the fruit, but the fact that the crosses are usually made with a Japanese variety makes for a markedly attractive plum as a result.

The Simoni is mentioned principally on account of its origin, being the only Chinese plum of its class, and also because it has become the parent of other and more desirable varieties.

The Plumcot is noticed as one of Luther Burbank's favourite crosses, *i.e.*, that between a plum and an apricot. Repeated trials here have failed to achieve any success in the fruiting and very little in the growth of this tree.

The Prune has become a distinctly commercial name for a certain plum of the domestic type known in France as the Prune d'Agen. For that reason, and also on account of its great importance in the dried fruit world, it is usually dealt with separately and so now although it is mentioned last on the list it is by no means the least important. The Prune d'Agen and a few other prunes have now become, at any rate, a commercial class by themselves; the list includes the Sugar prune, Italian prune (Fellenberg), Hungarian prune, Pond's seedling Imperial Épineuse, Robe de Sargent, Standard, German, and others. Most of these have, at some time or other, been introduced to and tested in South Africa. The result is that the Prune d'Agen still maintains the leading position and seems likely to continue to do so.

One other class of plums remains to be mentioned, and that is the ornamental or foliage class. It includes Pissardii and Vesuvius. The former bears the earliest plums we have, but they are only fit for cooking; the latter has an exceedingly attractive appearance due to its rich, red-coloured foliage. There are, of course, many other types of plums both of European and American origin, but they are little known in South Africa at present. With the growth of the industry it is extremely likely that introductions may from time to time occur, and they may eventually have some influence on the class of plum we produce. The beginning already made in the case of the Methley indicates the possibility of considerable interest being taken in producing local hybrids, and it is highly desirable that work should be taken up in that direction.

As has been mentioned, plums may be found in most districts from the coast to the very highest points in the Union.

As might be expected, the bulk of the trees are to be found in the Western Province of the Cape, the centre for the production of stone fruits of all sorts. The conditions which exist there are admirable for the culture of this fruit. Unlike the greater portion of this sub-continent, the rainfall occurs in winter time, thus

allowing a long dry summer in which all stone fruits rejoice and during which the ripening processes proceed uninterruptedly, thus assisting the production of sweet, luscious and perfect specimens of, not only plums, but all other stone fruits. The tree also thrives there owing to the abundant winter rainfall, which is conserved by proper cultivation methods. The soil, though it may not be as good as that found in other parts of the Union, is made good enough by the addition of the necessary fertilising agents and the resulting crops are truly marvellous.

Small, sheltered valleys are of frequent occurrence, and these afford perfect environment for the plum. Shelter from the south-east winds is to be assiduously sought for, as this is the one drawback to what might otherwise be well described as a perfect paradise for the grower of all kinds of stone fruits. It is a difficult matter to find any other district with conditions all round equally as good. Rail service is all that can be desired and distance to the port of export, *i.e.*, Cape Town, is in all cases moderate. As a producer of first-class plums, the Western Province of the Cape stands easily first.

The high veld of the Transvaal and Orange Free State offer infinite space for the planting of fruit trees of all kinds, and the plum being one of the hardiest is, in some variety or other, usually a success. Some of the best soils in the world are to be found there —rich, deep and easily worked. Sites can be selected occasionally which afford natural shelter for orchards, but as a rule the planting of some windbreak is necessary. Growth of all kinds of fruit trees is rampant and especially so in the case of the Japanese plum; trees in their second year frequently yield more than they can carry and in the third year a payable crop of fruit is often harvested.

Domestic types of plums are also to be found doing fairly well, though growth of the tree is not so rapid and it does not start bearing so early in life. The drawback to the production of this class of plum is that the tree is not as hardy as the Japanese against the effects of heavy rains and moist atmosphere, and as most of the rainfall occurs on the high veld when the fruit should be ripening, it will be seen that there is not much reliability to be placed in the getting of regular annual crops of domestic plums.

The principal trouble is that they crack badly, and this may be directly attributed to too much rain at the wrong time. Japanese plums rarely crack or split as a result of rain. They are regular and heavy bearers and are gradually displacing the domestic type on the high veld, and this notwithstanding that the latter are far finer in flavour. No Japanese plum, for instance, has the flavour of the Victoria or Greengage, but as these cannot be grown in South Africa, we have to make the best of those which we are able to produce. The huge area of the Karroo, with its splendid though

arid soil and surroundings, can and does grow plums wherever sufficient interest and water are obtainable.

In the Eastern Province also both classes of plums can be grown. On the Katberg mountains there are instances of some of the most popular varieties of the domestic plums succeeding and in the area round about Cookhouse and Somerset East some remarkable results have been obtained, both with the Japanese plum and, to a lesser extent, the prune also.

To Natal belongs the distinction of having done more than either of the other Provinces in the matter of originating new varieties of plums. The Methley, a chance seedling, is a cross between Satsuma and Myrobolan and grew from a seed thrown out from the kitchen of Mr. Methley's house at Balgowan. This plum was first planted about 1907 and was at once recognised by Mr. Methley as having great possibilities. It has since become one of our leading early plums and has done better at the Cape at an altitude of 400 feet than in its native place at an elevation of over 4000 feet. It has also proved acceptable in California. There are Francis and Westley also hailing from the Garden Colony. Conditions for plum growing in Natal are quite satisfactory in a limited way. The bulk of our plum export takes place from Cape Town, which is just a week nearer the market than Durban, and although Methley has been exported from the latter port, arriving in England in time for Christmas, it has not realised the prices obtained by the same variety from the Western Province. The local market is therefore what Natal growers largely depend on for the disposal of their crops. The growth of the tree throughout the Province is quite satisfactory and it is very free from diseases.

The cultivation of the prune on a commercial scale is at present confined to the Western Province of the Cape, where climatic conditions, as far as plenty of hot summer sun to develop the sugar contents is concerned, are perfect. The tree and in fact the prune industry were introduced by Mr. H. E. V. Pickstone in 1892, and as a result of his advocacy some thousands of these trees were planted shortly afterwards, mostly near the coast in the Western Province, and on the arrival of the author in 1898 he found a good many prune orchards already established. Yields were not, however, satisfactory, owing to heavy annual pruning to which the trees had been subjected, and as a result of change of methods from heavy pruning to practically none at all it was found that the trees got into better habits and bore fairly good crops of fruit. From that period the industry has never looked back, but has progressed so that we now have about 1,000,000 trees with rather more than half in the bearing stage. Of course, these are mostly to be found in the western and south-western portions of the Cape, where the

prune appears to be well established and regarded as a staple crop. It will probably be found as time goes on that the Robertson and similar districts will go ahead in the matter of prune growing, principally on account of the better and more suitable soils to be found there. Of all deciduous fruits none demands better soil than the prune and this is quite easy to comprehend when one considers the enormous and constant crops which are yielded.

Although other varieties of this fruit have been introduced, the Prune d'Agen is still the favourite. This plum appears to enjoy the climate found at the Cape from 400 to 700 feet and has attained its greatest perfection at those altitudes. Some little success has been attained in the growth of the prune in the Transvaal and a good evaporated article has been turned out at the School of Agriculture, Potchefstroom. The old experimental orchard at Ermelo also grew first-class prunes, but as they ripened in the height of the rainy season, it was impossible to prevent them cracking and their cultivation was discontinued.

The altitude at Potchefstroom is 4400 feet and at Ermelo 5600 feet, which seems to be about the equivalent of 400 to 600 feet at the Western Province of the Cape.

One of the most important considerations in plum culture is the selection of the right stock for the soil in which the trees are to be planted. The two things are interdependent, perhaps more so in the case of the plum than in that of any other stone fruit. There is a wider range of stocks to be dealt with and as a consequence a greater variety of soils.

The following are all pressed into service for use as stocks for the plum: the almond, peach, Marianna plum, Myrobolan plum. There are also other plums which are used as stocks in England and America, such as St. Julien and Mullet. These have not proved much of a success here and so no notice will be taken of them. It may be accepted as final that amongst the stocks in use to-day, the most useful and satisfactory for general practice in South Africa will be found.

Probably more plums of all sorts are worked on peach than any other stock. Our well-known South African yellow peach has proved to be so hardy, and is adaptable to so many conditions and classes of soil, that it has been accepted for general use by most nurserymen. It appears to be more particularly used as a stock for the Japanese type of plum and is found in every district. It is not too much to say that it is the favourite stock and suitable for soils from those of a light sandy nature to the heavy red loams embracing all the different types of red soil we have.

The peach almond, although a very useful stock, has not been extensively resorted to as a root for the plum, indeed instances of

its use are somewhat rare, yet it has many good qualities and not the least of these is its immunity to the effects of brack, which should be calculated to bring it into more general use. The prune worked on this stock has been known to survive and continue to bear good crops of fruit after other trees in the same orchard, worked on other roots, have died from the effects of brack in the soil.

The almond has certainly been used as a stock for the prune, but has never become popular. Instances have occurred of unprofitable almond trees being worked over to prunes and proving quite a success, but as a nursery stock for use in the propagation of plums of any kind, little demand has been experienced for it. The wide range of soils covered by the yellow peach has left no room for the use of any other kind of stock suitable for warm, dry environments.

The apricot makes an excellent stock for the prune and also for plums of the Japanese type. It is claimed that all varieties of plums worked on the apricot stock bear larger and finer fruits than is the case when worked on any other stock. There is, without doubt, some truth in this claim, but still there is a drawback to the general use of the apricot as a stock for the plum and that is the liability of the tree to part company from the root during the high winds, in other words the union between the plum tree and the apricot tree, which takes place at the point of grafting or budding, is not of the strongest and a high wind may blow the tree over. But the apricot root has a good point, in that it will put up with quite a lot of brack in either soil or irrigation water; it is in fact equal to the peach almond in that particular. That is one of the reasons why, in parts of the Karroo where water is brackish, one may find magnificent old apricot trees still standing while those worked on other roots have died. There should therefore be some prospect of the apricot being utilised as a stock in certain sheltered parts of the Karroo.

The Marianna plum, a particularly hardy variety, is in general use in Natal as a stock. Apparently its behaviour is better there than at the Cape, where it is rarely employed. It succeeds in a drier class of soil than the Myrobolan, which has the name of being more at home in somewhat damp and heavy soils than any other stock. The Myrobolan plum, one of the survivals of the early introductions at the Cape of a previous century, has proved most useful as a stock and is still largely in evidence. Large quantities of this stock were imported from France and the practice continues, but only 4000 were imported into the Union in 1923. Many thousands of prune trees are worked on this stock, and there is no doubt but that it is the most suitable for that fruit on anything like damp or clayey soils.

Domestic plums are also worked on it, and in addition some kinds of Japanese. It is singular that some plums of this type, such as

Kelsey and one or two others, do so well on Myrobolan, whilst the majority of the rest do not appear to have any affinity for it and do not succeed.

Large numbers of Japanese plums have been planted as fifth trees, or catch crops between other kinds of fruit trees, principally pears, on account of the fact that they come into bearing at such a very early age. A common distance to plant pear trees is 24 or 25 feet apart in squares, and that allows for a plum tree in the centre of each square. When Japanese plums are planted alone in orchard form, much will depend on the habit of growth of the individual variety selected as to the distance apart at which they should be planted. Trees of a naturally spreading habit, such as Apple or

YOUNG JAPANESE PLUM ORCHARD. WESTERN PROVINCE, C.P.

Satsuma, will require more room than upright growers like the Wickson and Santa Rosa. For the former, 24 feet is necessary, while for the latter a distance of 20 feet should suffice.

The question of pollination should be studied when planting out plums of the Japanese type in orchard form. It is true that most varieties are self-fertile and are inclined to bear too much instead of too little fruit, but there are cases where the Wickson has steadily refused to bear until Satsumas were planted in close proximity. The Apple plum is sometimes a very shy bearer and so far its affinity does not appear to have been found. It is wise, before planting, to make inquiries locally as to the habits of different varieties, as it has been shown that some fruits, self-sterile in one area, are entirely self-fertile in another. A few hives of bees are an asset to most orchards.

The prune (Prune d'Agen) is self-fertile the world over. While many other varieties have been introduced with the object of increasing the size of the fruit—and this has occurred more particularly in California—not one has equalled the original French Prune for quality, sweetness, flavour or heavy yields. No other variety is grown in South Africa for the special purpose of producing dried prunes. The best distance to plant the prune is about 24 feet apart, preferably in squares. A good deal will depend on the growth of the tree, and this again will depend on the soil on which it is planted. In some of the coastal districts, growth is slower and the tree does not attain such size as it does at higher altitudes with better soils. In such places a distance of 20 feet should be sufficient.

The Prune d'Agen requires pruning during the first two and perhaps three years of its life only. This is in order to build up some foundation for the future tree and to admit of the throwing out of low branches. Constant cutting back every winter results in the forcing of rampant wood growth, and this occurs at the expense of the fruit. Enormous yields, such as those the prune gives, cannot go hand in hand with excessive wood growth, and so, as the tree is grown for fruit only, it is best to allow it to follow its own inclination and grow and bear fruit naturally. If this is done, heavy crops occur regularly for many years; fertilising should be resorted to in order to maintain the soil in good condition. If it is not, crops come perhaps every other year and do not consist of very fine fruit. The policy of allowing huge crops of prunes to materialise annually without any attempt being made to fertilise the soil is a poor one. Prune soils should not be allowed to become exhausted, but fertility should be maintained by annual dressings of fertilisers of a complete nature. Ordinary stable manure may be applied regularly with considerable benefit to both the tree and the mechanical condition of the soil. With systematic fertilising the size of the prunes is very materially increased. Prunes are never thinned like other plums; the same necessity for producing extra fine specimens does not exist. Japanese plums are exported largely and the finest fruit fetches fancy prices. For that reason thinning is imperative with fruit of that class.

The practice of both thinning and regularly fertilising is particularly desirable in the case of many sorts of Japanese plums. Frequently the Kelsey, for instance, will set more fruit than it has leaves, the fruit is thicker than peas in a pod, and if grown for export thinning is imperative, and for specially fine fruits, fertilising is equally so. The action of fertilisers is most noticeable in the size of the fruit, which is increased materially by their use.

Unlike the prune, Japanese plums of all varieties require regular

annual pruning. Fine fruit is what most Cape growers are after, especially for export. Up-country orchardists are not so particular about size; their object is early fruit and lots of it, so that the advantage of high prices in the early part of the season may be obtained.

Japanese plums may be roughly divided into two classes—upright and spreading growers—and though the shape of either may be to some extent modified, the natural tendency will at all times make itself manifest. Upright growers such as Wickson, Santa Rosa, Gaviota, Formosa, Botan and Chabot have a tendency to carry too many branches, and the principal pruning in the case of these is to thin out, always leaving a sufficient number to produce the crop which is required. If specially fine fruit is wanted, then the number of limbs may be reduced to four or six, and if size is not as much an object as quantity, then more branches may be allowed to remain. Most of these upright growers do not require much pruning of laterals.

Plums of spreading habit, such as Apple plum, Satsuma, Burbank, and others carry much fruit on the laterals and require pruning if only to strengthen the remaining growth. The encouragement of upright growths is also necessary, otherwise the heavy fruiting is liable to cause the branches to sag and prevent proper development of the tree. The bigger the tree, the more fruit it will carry, within bounds. Low heading of both types of Japanese plums is advisable and should be followed.

The scarcity of plums of the domestic type renders it unnecessary to dwell long on the subject. Those most in favour are the Damask, Czar, Diamond, Pond's Seedling and Pride of England. They are all more or less slow growers and require regular annual pruning if only to encourage growth. As there is not much tendency for the tree to become bushy through the production of too many branches, the necessity for thinning out rarely occurs. Laterals require shortening annually.

The Myrobolan hybrids, like Methley, Combination and others, should be treated like upright growing Japanese varieties.

Very little irrigation is done in connection with plum growing in South Africa.

Packing and Grading.—For local markets this is a simple matter. In the immediate vicinity of large towns, the object should be to keep the market supplied with consignments of nice fresh fruit daily. A delivery by motor-lorry each morning or even twice daily is usually a profitable undertaking. Empties can be returned on the home trip. Most of the plums sold on our local markets are Japanese and many of these are disposed of in boxes identical with those used for export. Wood wool is used for packing and some-

times in the case of small varieties a double layer is put in. The very early plums are often offered for sale before they are ripe or even fit to cook, the idea being that anything in the way of a fruit will sell. In any case, plums should not be offered for sale until they have, at any rate, an appreciable amount of colour. For export purposes, the same remarks hold good. The Kelsey in particular is often sent away in too green a stage altogether. Colour is a very material factor in selling plums; poor fruit of good colour will sell better than a good plum of poor colour. Grading is done sometimes in the orchard and sometimes in the packing shed. Machine grading is not general in South Africa, therefore each fruit is passed through the grading board. The grades are as in the case of other stone fruits, that is "Extra Selected," "Selected," "Choice," "Graded."

Certain sizes are laid down which define each grade as far as size is concerned. There is at present no limit as to size; very large or very small fruit may be exported providing that it is marked in accordance with the Government regulations, denoting under which grade it falls.

The varieties principally grown are as under. No attempt is made to enumerate all the different types of plums which grow here, only those of interest commercially, or for domestic use.

Japanese Types.—Abundance : or yellow-fleshed Botan, is medium to large in size; shape roundish with slightly pointed end; skin yellow, almost entirely covered with dark red; flesh yellow and sweet; stone small, as is the case of all Japanese varieties, and clinging. A good plum for dessert purposes. Ripens according to locality, from December onwards. Tree is a free upright grower and fair bearer. Suitable for almost any part of the Union, but in the Transvaal, Orange Free State and Natal does best at 4000 feet and over.

Apple.—A very large plum with light almost white bloom. Shape round and flattened; skin dark red; flesh red to stone, to which it clings, of excellent flavour. One of the best export plums fetching the highest prices on the London market. Tree is of spreading and willowy growth, requires pruning regularly summer and winter, is only a fair bearer. May be grown in any part of the Union. Does better in the Transvaal, Orange Free State and Natal at over 4000 feet.

Beauty.—This is the latest introduction in the way of an extra early plum. The variety was originated by Luther Burbank of California, who has done so much in this way. The tree is strong, an upright grower, bearing fruit of heart shape; large in size and of attractive colour. Ripens with Methley. It is a good shipper and will do well on local markets. Mr. Buller of Stellenbosch,

who has distributed this variety, says: "It will carry well to the London market, opening up with a highly attractive waxy appearance and deep red colouring developing."

Burbank.—Size, large to very large; shape almost round; skin light, shaded to darker red with light bloom; flesh yellow, sweet and juicy. Is good for local markets and has been largely exported, but is not a favourite kind for that purpose. Tree is a strong and vigorous grower of rather spreading habit. Ripens January. Can be grown anywhere in the Union.

Chabot.—Size, medium to large; skin red to dark red; flesh yellow, sweet and well flavoured. Good for local markets. Has not been exported and is not recommended for that purpose. Tree strong, upright grower. Ripens December to January. May be planted anywhere in the Union.

Chalcot.—Introduced by Messrs. Pickstone in 1899 at the same time as the Apple and Sugar prune. Size very large; small specimens are unusual; shape flat like a tomato; skin bright crimson; flesh yellow, firm and sweet. An excellent shipping variety. First exported by the author in 1902, when it fetched 40*s.* per case. Is still a valuable export variety, averaging about 9*s.* per case. Ripens February. Tree is a strong upright grower and fair bearer. May be grown almost anywhere in the Union, but does best in the Cape Western Province.

Formosa.—Introduced in 1908 by the Transvaal Agricultural Department along with Gaviota and Vesuvius. Size large to very large, shape roundish with tendency to a blunt point; skin yellow until ripening, when it turns rich cherry-red; flesh yellow, firm and sweet, with almost free stone. Is an excellent export variety and has realised very high prices. Ripens January. Tree is a strong upright grower, but shy bearer. Does best in the Western Province.

Gaviota.—Size large to very large; shape round, ending in longish point; skin deep red; flesh yellow, firm and sweet. A good export variety. Ripens February. Tree a very strong upright grower and regular bearer. Does best in the Western Province of the Cape, but will do well in the Transvaal, Orange Free State and Natal at 4000 feet and upwards.

Hale.—Size medium; shape round; skin yellow; flesh yellow, firm and sweet. Useful for local markets. Ripens January. Is the most vigorous and rapid grower of all plum trees, dwarfing all other varieties planted at the same time in a few years. Is a good bearer and will grow anywhere in the Union.

Kelsey.—Size large to very large, when well grown it is the largest of all plums; shape round, tapering to a point, often called "heart-shaped"; skin when half grown is green, turning later on to yellow and when fully ripe to deep purple-red; flesh yellow, tender yet

solid, sweet and juicy. One of the best export plums, always bringing good prices. Is occasionally used for drying, and is the best Japanese plum for that purpose. The last plum to ripen. Tree a good and healthy grower, wood not thick and the tree is very apt to overbear. Must be thinned and pruned regularly. Will thrive in almost any part of the Union.

Kerr.—Belongs to that class of yellow plums sometimes (quite wrongly) called Japanese Greengages, and includes Ogon, Ogon Nagate, Shiro Smomo and First. Kerr is of medium size; shape round; skin yellow; flesh yellow and very sweet. Good for local markets, being used for preserves and dessert purposes. Ripens February. Is particularly good on the high veld at above 4000 feet in the Transvaal, Orange Free State and Natal.

Menne.—Is a new plum originated in Natal by Major Menne and introduced to the trade by Messrs. Geo. Carter and Co., of Maritzburg. It is a cross between Wickson and Pottowattamie (a Canadian plum). Size large; shape oval; skin bright red; flesh yellow, juicy and of excellent flavour. Ripens in Natal in early January. Tree is rather low-growing, of spreading habits and is an excellent bearer. Major Menne says it is a good export plum.

Methley.—This is a Natal product, originated by Mr. Willoughby Methley at Balgowan, and is a cross between Myrobolan and Satsuma as a chance seedling. Size depends entirely on soil and cultural methods. In Natal it is not a large plum. At the Cape it attains a good size and is often large. Shape round to slightly oval; skin dark red covered with a light bloom; flesh red to the stone; good flavour, melting and juicy. Is a good variety for early local markets and has been exported in time for the Christmas market in England. Is one of the earliest plums we have of any value. The tree is an upright, fairly rapid grower, resembling its Myrobolan parent and is a heavy bearer. Thick grower and requires thinning annually. Will thrive almost anywhere in the Union.

Myrobolan, Myrobelle, Christmas or New Year Plum is well known all over South Africa by one or the other name. Fruit small, round in shape, not much larger than and very like a cherry in appearance; indeed it is occasionally called the Cherry plum. Skin either yellow or bright cherry-red; both colours are equally common; flesh thin and watery, and only fit for cooking purposes. Ripens almost as soon as Methley, occasionally earlier, depending on locality. Is an upright grower and fitful bearer. Will grow anywhere in the Union.

Maynard.—Size large; shape almost globular; skin deep crimson-purple; flesh firm and juicy. A good plum for local markets. Has not hitherto been exported. Ripens early. Suitable for

Natal, Transvaal, Orange Free State and Western Province of the Cape.

October Purple is a seedling propagated by Luther Burbank, of California. Size large to very large, shape round with slightly pointed end; skin dark reddish-purple; flesh yellow, firm, sweet and of good flavour. Good for local and export markets. Is a good bearer. Fruit ripens late February or March. May be planted almost anywhere in the Union.

Santa Rosa.—This is one of the most profitable and popular of recent introductions. Size large; shape oval, running out to a point; skin dark crimson-purple; flesh red to the stone, firm, sweet and of delicious flavour. Is one of the best export plums. Ripens December. Tree is a good strong upright grower and regular bearer. One of the best. Suitable for almost any part of the Union. The author has fruited it from Ermelo at close on 6000 feet to nearly sea level.

Satsuma.—This is one of the earliest introductions from Japan, whence it was taken to California and thence to South Africa. It is the parent of all other red-fleshed plums and one of the best. Size large to very large; shape roundish with a slight point; skin dark red with dots and covered with thick bloom; flesh red to the stone, firm and of good flavour. Is a capital plum for all local markets, good for preserving and one of the best canning plums. As an export plum, it is hard to beat on account of its superior carrying qualities. Ripens January. Tree is a free grower, with slightly spreading habits and a regular and heavy bearer. Can be planted anywhere in the Union.

Shiro Smomo is the principal plum of its class grown here. Size medium to large; shape round; skin yellow; flesh yellow and sweet. Useful for local markets. Ripens January. Tree a fairly strong grower, of rather spreading habits and a very heavy and regular bearer. May be grown almost all over the Union.

Sultan.—This is a blood-red plum. Size large; shape elongated and pointed; skin red to dark red; flesh red to the stone, firm, sweet and juicy. The first crop only may be exported, second crops do not carry. Good for local markets. Tree is a vigorous upright grower and good bearer. Ripens in January. May be planted in the Western Province of the Cape and does best in other provinces at over 4000 feet.

Tagazine.—Raised from seed by the late Mr. Wesley Francis, of Maritzburg. Said to be a cross between Hale and Satsuma. Size medium; shape like Methley; skin dark red; flesh red to the stone. Good for local markets. Ripens rather earlier than Methley. The tree is a vigorous grower and heavy and regular bearer. Suitable for the warmer portions of the Union.

Wickson.—One of the most popular of the Japanese plums. Size large to very large, somewhat heart-shaped with elongated blunt point; skin greenish to cream in colour with whitish bloom, but when ripe is a bright red colour; flesh yellow, melting, sweet and juicy, and of a delicious flavour. A good variety for export and also for local markets. Tree is a strong upright vigorous grower and regular bearer when pollinated with Satsuma. Otherwise, often a shy bearer. May be planted all over the Union, but does best in the Western Province of the Cape.

Wright's Early.—May be classed as an early Burbank, to which variety it bears a strong resemblance. The tree has the same habit of growth and the fruit is almost identical. Ripens in December.

Domestic Plums :—Czar. A large to very large plum; shape roundish oval; skin, prior to ripening, a dull red, but when fully ripe is very dark purple and has a blue bloom; flesh yellow, tender, juicy and of good flavour; freestone. A good dessert plum and useful for local markets. Ripens February.

Damask. There are many types of this plum. The one generally grown here is a handsome looking fruit of medium to large size; shape oval; skin purple, covered with thin, almost white, bloom; flesh yellow, sweet and juicy; freestone. Is an excellent dessert and cooking plum. Good for local markets. Ripens February to March.

Diamond. Size large to very large; shape oval; skin dark purple, covered with light blue bloom; flesh yellow, coarse, juicy and slightly acid; clingstone. Is a good cooking and preserving plum, suitable for local markets. Tree is a good grower and bearer. Ripens in February.

Greengage. One of the choicest and best-flavoured of all plums. The original type is supposed to have come from the east to Italy, and thence to France and England, where it received its present name. Size medium, shape round, slightly flattened at each end. Skin greenish-yellow, becoming a deeper yellow when ripe, with cloudy green markings; flesh greenish-yellow, tender, sweet and very juicy and of a flavour which is unique. The best dessert plum grown. Ripens February to March, but is less of a success here than any other of the domestic class of plum.

Pond's Seedlings known in California as Hungarian Prune, is a large fruit, oval shape. It has a tendency to come double. Skin reddish-purple with light bloom; flesh yellow, sweet and juicy. Useful for cooking and preserving purposes. Ripens February to March.

Pride of England. One of the most successful of the domestic plums here. Size medium; shape roundish ovate; skin dark purple, flesh yellow, slightly acid; freestone. Useful as a dessert

and cooking plum. Ripens January. Tree fair grower with spreading habit and good bearer.

Rivers' Early Prolific. Raised by Mr. Thomas Rivers at Sawbridgeworth, England. Size medium; shape oval; skin purple; flesh yellow, tender and juicy. Is an excellent cooking plum and good for local markets.

Rivers' Late Prolific. This is a seedling of the last-mentioned and similar in most respects, but ripens three weeks later.

Standard of England. Size medium to large; shape oval, slightly larger at the stem end (obovate); skin bluish-red; flesh yellow, firm yet juicy; clingstone. Good for cooking, preserving purposes and local markets. Ripens January.

Victoria. A favourite English variety. Fruit large; shape oval. Skin pale red in shade and bright red on the sunny side, covered with light bloom; flesh yellow, juicy, sweet and of exquisite flavour; freestone. Suitable for dessert, culinary purposes and local markets. Ripens February.

The above plums, without exception, are likely to do best on the coast at under 600 feet and inland at an altitude of over 4500 feet and upwards. Some of the favourites, such as Greengage and Victoria, are very shy bearers, but where they can be produced they are always appreciated.

Damsons. Very few damsons are to be found in South Africa. The author has fruited them successfully at Potchefstroom. The Bullace, a round damson, yields immense crops. The fruit is better known in England than elsewhere and is very popular there for preserves. No South African nurserymen list them at present.

Prunes. Prune d'Agen—the prune of commerce, grown so extensively in Europe and America (California). One of the most profitable plums to grow when all the necessary conditions of soil, climate and culture are supplied. The fruit is medium to large in size, shape oval. Skin dark violet-purple; flesh yellow, sweet and of good flavour. Fruit is almost entirely used for drying purposes. Tree a good grower and heavy bearer. Ripens February and will grow and fruit almost all over the Union. It is not wise to plant this plum in any district subject to summer rains, as the fruit cracks badly, and so is unfit for drying. Success should be found principally in the deep Karroo soils of the Eastern Province and the Cape midlands under irrigation. In the Western Province the tree is rarely in need of irrigation water.

Robe de Sargent. Another prune introduced as being larger in size than the last mentioned. It is not, however, as satisfactory a bearer, and for that reason has not met with the success anticipated.

Sugar Prune. Introduced by Messrs. Pickstone in 1900. Size large to very large; shape oval; skin dark blue, almost black;

flesh tender and juicy, yellow in colour. Is useful for local markets and has not so far been dried in South Africa. This is a good grower suitable for the Western Province of the Cape, principally. Ripens February.

Tragedy Prune. Introduced by Messrs. Pickstone, but is now largely discarded. It is, however, worth cultivating as the earliest dark blue plum. Size medium; shape oval, flattened at both ends; skin dark blue to black, with light blue bloom; flesh yellow, sweet and tender. Is a good plum for the early season's markets for dessert purposes only. Tree a good grower and fair bearer. Ripens December.

Fellenberg or Italian Prune. Size medium; shape longer than d'Agen and pointed at each end; skin dark purple covered with heavy blue bloom; flesh greenish yellow; tender, juicy and sweet, though not as sweet as d'Agen. Suitable for drying, also cooking and dessert. Ripens February. Tree is a good grower and heavy bearer, with spreading habit of growth. Suitable for Eastern and Western Provinces of the Cape, and high veld of Transvaal, Orange Free State and Natal.

Ornamental Plums.—So called on account of their foliage, which is of a coppery red colour. The fruit borne is of little or no value. The contrast of colour, caused by planting trees of this type amongst those of ordinary foliage, is very striking and effective.

Pissardii and Vesuvius are most in demand, the latter being an extremely handsome tree, both as regard colour and shape. The leaves have a redder tinge than those of Pissardii, are longer, and the tree is altogether more attractive in appearance.

CHAPTER XVIII

THE FIG

The fig tree is the first of all fruit trees to have attained notice. It is mentioned in the book of Genesis as having provided the means of clothing our common mother, Eve. It is true, the apple is sometimes referred to as the "forbidden fruit," but this is pure conjecture, for it is certain that there were no apple trees in that so termed "Garden." That the fig was there is equally certain. It is found to-day in varying types all over the hotter portions of the Eastern Hemisphere and embracing that part thereof which from time immemorial has been regarded as the cradle of our race.

There are great numbers of different species of figs, of which many are indigenous to Africa. Amongst them may be classed the famous Wonderboom, just outside Pretoria, one of the largest known of our native trees.

The edible fig, or fig of commerce with which this book is concerned, belongs to one of the many families and it may be as well to say that its name, botanically, is *Ficus carica*. It is with figs of this class only that we shall deal.

For present purposes we will divide it again as follows:—

1. The Capri, or wild fig, which is found on the islands and along the shores of the Mediterranean Sea and which provides a home for the fig wasp or *Blastophaga*, which for many centuries has been utilised in fig-producing centres for the purpose of pollinating figs of the Smyrna type.

2. Figs of the Smyrna type which are of themselves unable to mature their fruit without the aid of the *Blastophaga*. The seeds of such figs after pollination and ripening may be planted and will then germinate. Figs of that class are termed "self-sterile."

3. The so-called self-fertile figs, which include the majority of varieties of edible figs commonly grown in South Africa. These become ripe and fit for eating purposes without the aid of pollination, but they are not fully ripe from a botanical standpoint, *i.e.*, the seeds will not germinate, not having been pollinated. It follows that trees of this type can only be propagated by means of suckers, cuttings, layering or grafting.

4. There is a further type of fig which is able to ripen one crop per annum without the aid of cross-pollination, but unable to produce a second crop unless that function takes place.

These different classes of figs comprise all which are of interest from a horticultural standpoint. It is proposed to deal with them separately as far as is possible, but classes 1 and 2 are so intimately concerned that they must eventually be linked up.

Taking class 3 first, we find that it comprises a very large percentage of those varieties which we are accustomed to in South Africa. They are at present grown in far larger numbers than the Smyrna type. The principal ones are Adam, Brown Turkey, Brunswick, Castle Kennedy, White Genoa, White Ischia, Old Cape White, Tiger, White Adriatic, Negro Largo, Osborne's Prolific. All these varieties are well known and generally planted throughout the Union. Amongst them are those which were first brought to South Africa and these in all probability were Adam, Brown Turkey and Old Cape White. In addition to the above there are a very large number of other varieties which at one time and another have been introduced into the country. There has been a very great duplication of names amongst them, some varieties having no fewer than seventeen synonyms. This is due to lack of organisation amongst horticulturists and nurserymen. It has been common to name a variety after the place where it is largely cultivated, after the name of an individual and sometimes after a friend. Fortunately, this practice is getting a bit out of date and most of our present-day nurserymen strive to give each variety its correct name.

Class 2:—*The Smyrna Figs.* Varieties of these have been in South Africa for many years past and undoubtedly caused much disappointment amongst their owners owing to the fact that they persistently dropped their fruit before it came to maturity. It is only since the introduction of the Calimyrna, the drying fig of Asia and California, that satisfaction has been obtained.

The name Calimyrna was given to this variety by Mr. George Roeding, of Fresno, California, previous to that it had been known to most growers as the Smyrna Fig. It may be added that the Calimyrna was selected as being the best from amongst a number of Smyrna figs, and under that name it was introduced into South Africa by the Cape Agricultural Department in 1893. One or two similar types called Kassaba and Bajardic were brought in at the same time. The Calimyrna is, however, the one fig on which commercial interest is concentrated, in that it is without doubt not only the best drying fig but also the best flavoured fig for ordinary eating purposes. A large business is done in shipping this fig in its green state from California to the large cities of the Eastern States of America.

3. *Capri Figs.* Without the presence of these wild or male figs, the Smyrna would have been valueless. The experience of Mr. Roeding, who planted an orchard of some hundreds of Smyrna figs

SIX-YEAR-OLD GENOA FIG TREE, ORCHARD OF J. H. WHITLEY, NEAR JOHANNESBURG.

at Fresno, showed that without the presence of the *Blastophaga* it was impossible for the trees to mature their fruit and the search for it and its final introduction into the State of California forms a horticultural and entomological romance. As the insect makes its home in the wild or Capri fig it was essential that this class of tree should also be introduced and this was accordingly done.

The establishment of the dried Smyrna fig industry was regarded as a national undertaking. Private enterprises, assisted by the Press (the *San Francisco Bulletin*) and numerous individual investigators and finally by the United States Department of Agriculture all joined in the effort to solve the problem as to how to make the Smyrna fig mature its fruit. Mr. Roeding had shown that by transmitting the pollen of the Capri fig artificially into the flowers of the Smyrna the result was the production of mature specimens of fruit. How to do this naturally was the difficulty. Finally in 1899 the problem was solved by Mr. Walter Swingle, of the United States Department of Agriculture, who forwarded numbers of the *Blastophaga* to Mr. Roeding from Algiers. The change of environment appeared to agree with the insects, for they increased and multiplied as only insects can. There has since been little trouble in fertilising the Smyrna fig there.

It has been said the Capri fig is the home of the *Blastophaga*. It may also be mentioned that many of the wild fig trees of South Africa carry large numbers of these insects, of different species, not the *Blastophaga grossorum*, but of a similar type. It has been stated that each kind of wild fig in South Africa has a different kind of fig wasp which lives in the fruit thereof; this is probably incorrect, but in any case none of them would be of any use to pollinate the Smyrna.

In order that the insect may always have a home, there must always be figs on some of the Capri fig trees, and so it was necessary to have a number of them in order that one crop of fruit might overlap the following one. Capri figs and many other figs bear two or three crops of fruit annually. The first crop of Capri figs is called " Profichi," the second crop " Mammoni " and the third " Mammei."

Thus there are nearly always figs present in which the insects may find a home. Mr. Tribolet, the late Chief of the Horticultural Division, stated in a lecture delivered before the Paarl Farmers' Association in 1911 that the first crop of Profichi figs is entered by the *Blastophaga* in the second week in September and that they emerge in the second week in January.

The second crop, the Mammoni, is entered the second week in January and the insects emerge in the second week in March, whilst the third, or Mammei, crop of figs is entered during the second

week of March and the insect emerges the second week in September. Thus the circle is complete.

However, it has been known to happen that something or other interferes with the regular routine outlined. Perhaps a frost or bad weather occurs and the sequence is broken. Then it is a matter of some urgency to send to another district, other than the one in trouble, and secure a supply of *Blastophaga* from there. Occasionally in the Mediterranean and surrounding districts interested in fig culture, when from some cause or other the insects are destroyed, a very large demand arises and figs containing the insects are bought from more fortunate districts at fairly high prices.

It has been seen that the fig wasp depends for its existence on the Capri fig and the Smyrna fig for its ability to mature fruit on the fig wasp, without which the tree is sterile. Pollination is effected in a different manner in the case of the fig from that of any other fruit. In other fruits pollination is either necessary or desirable, and it occurs principally by the visitation of different insects which travel from flower to flower and distribute pollen dust on their way. Moths, flies and bees all help, but in the case of the fig matters are different. Instead of being outside and easy of access the flowers of the fig are contained within the fruit skin and are on that account out of reach of all ordinary insect life, which in other cases is so useful in the work of pollination.

Nature has, however, provided an insect which can enter the fig at the little hole at the apex of the fruit. This is the *Blastophaga* or fig wasp. It is a very tiny black fly and it almost requires a microscope to see it. In order to pollinate the Smyrna fig, the pollen must be transmitted from the interior of the Capri fig. All flowers contained within the Capri fig are either male, female or gall. The first are found just inside the eye of the fruit and they are the pollen-bearers. They are present in the first and third crops of the Capri figs, *i.e.*, the Profichi and the Mammei.

In the Smyrna fig the flowers are female and will only produce seeds after pollination. Thus until and unless they are properly fertilised by the introduction of pollen from the male fig they are useless and the fruit does not mature.

The male flowers are those which are found in what has been termed Class 1 figs. The gall flower is that portion of the fig which the economy of nature has provided for a receptacle for the eggs of the *Blastophaga*. It is within the walls of this cell that the young insects live and grow until the time has arrived for them to set forth on their errand of pollinating the female flowers; they emerge from the gall cells and in a state of nature find their way to the female flowers of neighbouring trees. The Smyrna fig is not, however, near when they grow in their natural state, so it is customary to

plant a number of Capri fig trees in conjunction with each orchard of Smyrna figs in order that the *Blastophaga* may be on hand and ready to enter them when they are ready for pollination.

It is usual to take a number of Capri figs containing the insect and string them up in little lots of 10 to 20 in a bunch and hang them up in the Smyrna fig trees so that they may find a place ready for them as soon as they emerge from their homes. As they come out from the gall flowers they pass through the male flowers, which are bunched up at the eye of the fig and become covered with pollen, and it is this pollen from the male flowers of the Capri which fertilises the female flowers of the Smyrna fig. As they enter the latter through the opening at the end of the fruit, they brush up against the female flower, and by distributing the pollen grains over them thus render them fertile.

It is necessary to be sure of the stage of existence which the *Blastophaga* has reached before the figs are hung up in the Smyrna trees. This is done by examining the Capri figs, and if they are found to be in the right stage they are then hung up in the Smyrna fig trees. Thirty figs from the Capri will be sufficient to fertilise a large Smyrna tree. Two or three bunches of Capris (five to a bunch) are sufficient for a small tree.

As all the Smrynas are not ready to be fertilised at the same time, it is as well to hang up more bunches of Capri figs ten days or so later in the Smyrna trees, and even a third time if necessary. It will have been noticed that for the successful breeding of the *Blastophaga* no fewer than three varieties of Capri figs were necessary and on that account were introduced by the Agricultural Department into South Africa. Strange to relate, during the whole period prior to 1899, when the Californians were putting forth every effort to get at the secret of pollination and afterwards to introduce the insect and generally to found a dried fig industry by every means possible or impossible including the introduction of many kinds of Capri figs for the *Blastophaga* to breed in, there was in the orchard of Mr. Maslin, of San Joaquin County, a Capri fig tree which carried figs all the year round, in which the insect had been living and breeding in uninterrupted happiness since the year 1880. Had this only been known, much time and many thousands of dollars would have been saved. This tree was named the Milco and the author brought back cuttings of it from California in 1911. They were planted at Elsenberg College, but owing to unfortunate conditions, all but one died. This one has apparently never thriven properly and it might be wise to procure more cuttings of this particular variety, together with others which have been developed in the past few years. (*Note.*—Some cuttings taken from this tree are now flourishing.)

In those districts which are most favourably situated for the growth of the Milco it should be unnecessary to have more than that one variety in order to secure a sufficient and regular supply of the insect, instead of, as formerly, at least three times the number of Profichi, Mammoni and Mammei. In our nurserymen's lists, the Capri figs were quoted as No. 1, No. 2 and No. 3. In others, where for some reason or other the Milco does not thrive, it will still be necessary to have the three varieties and perhaps others as well, as new introductions of Capri figs, such as seedlings, etc., are constantly being made. The pollination of the Smyrna fig by the *Blastophaga* emerging from the Capri fig and entering the Smyrna is called " Caprification."

Districts for the Fig.—Fig trees are found growing in each Province of the Union, the largest number being in the Cape. The districts principally interested are Oudtshoorn, Melteno, Calvinia, Ladismith, Worcester, Paarl, Robertson and Montagu.

There are over 300,000 trees bearing and non-bearing in the Cape, and in the Transvaal about half that quantity. The Free State has over 200,000 trees and Natal about 40,000. Green figs for eating purposes are largely in evidence on the markets of Cape Town and Johannesburg. The best fig areas in South Africa are in parts of the Karroo, the trees attain there a very large size and a considerable amount of drying is carried on. In the Eastern Province there are also a number of fig trees, but they are not grown with any idea of drying the fruit excepting perhaps on the Sundays River. Neither the Transvaal nor Natal makes any pretensions to produce dried figs suitable for commercial purposes.

The fig tree will grow in almost any district where temperatures do not fall to below 20° Fahr. in the coldest portion of the year. A native of the tropics, it thrives better in a warm climate and for commercial purposes does best where little or no frost occurs. Its requirements are, in fact, very much the same as those of the orange. It does not like cold and damp summers with misty atmosphere, and whilst it will grow and produce fruit under such circumstances, it cannot be done on a large scale. Garden trees may be grown, but not orchards. The hot summers of the Karroo with the normal temperature found there in the winter appears to suit the tree to perfection.

Very fine figs are produced in the midland and south-west districts of the Cape, and it may safely be said that for the production of best quality figs these are the most suitable parts of the Union. Not only is this the case, but the unrivalled summers afford ideal conditions under which to produce first-class dried fruit of any description, and especially figs.

Soils.—The fig tree will grow in almost any kind of soil and, other

features being favourable, produce a good crop of fruit. Naturally when one proposes to grow figs for profit, it is wise to look for the soil which suits both tree and fruit, and this is to be found in some of the districts already mentioned. The deep sedimentary soils of the Karroo are admirably suited both to the growth of the tree and the perfect ripening and drying of the fruit. In the more sandy soils of the Western Province the fig attains a large size and fine appearance, but this is more as a result of the moisture found in the ground in that area than from any inherent quality in the soil. Figs grown under these conditions do not make a good drying fruit.

Smyrna and White Adriatic figs of perfect quality can be grown and dried in the midland and south-western areas of the Cape, but in most cases the application of irrigation water is necessary. This work requires the exercise of very keen judgment in order to provide just the exact moisture conditions to mature a perfect drying article. As a rule three irrigations are sufficient and the latest of these should be given not less than a month before the fruit ripens. It has been found that a surplus of water after that time causes the figs to go sour and ferment during the process of drying. Practice alone can inform the individual grower as to the best times to water and the right quantity to give, as much depends on the kind of soil in which the trees stand, quite apart from local conditions as to rainfall.

Propagation.—Figs are propagated principally by means of cuttings and suckers, probably more by the former than by the latter method. It has been pointed out that they will grow from seed also, but in nursery practice this method is not resorted to. An amateur gardener will find endless interest in planting seeds of figs with the object of originating some new variety. As a rule, the kind of fig wanted is produced by planting cuttings or suckers from trees of that particular variety.

Cuttings may be taken either from the ends of the branch when they are called " tips " or from any other part of the branch of the requisite size and state of maturity. Whichever may be used, the time for taking them is the same and should be after the wood has thoroughly matured, June being a good month. " Tips " may be cut about 12 inches long for planting and set out with the tip showing about an inch above ground. They should be cut immediately below the joint or node.

Ordinary cuttings are best about 15 inches long; they should be cut in the same way and planted with one bud only showing above the ground; the tops of the cuttings should be waxed over with grafting wax. Particular attention should be paid to the planting of the cuttings. They should be set out in rows in soil which has been thoroughly well pulverised and can be kept at a fairly uniform state of moisture. They may be set 6 inches apart

in the rows and, at the end of the first season's growth, planted out in ordinary nursery form in rows 4 feet apart and 12 inches apart in the row. At all stages of the propagation period, and especially at transplanting afterwards, ample moisture should be maintained. It is not necessary to protect the young plants from the sun, but they should not be planted in a situation likely to prove too cold at night. A sheltered position is always desirable.

If it should be necessary to propagate a number of trees of some new or special variety and wood is scarce for use as cuttings, the fig can be propagated from single eyes or buds. Work of this nature requires special precautions to prevent drying out of the soil, which should be of a light sandy nature. It is best to do all propagation of this nature, calling for special care, under a frame in order to control the matter of moisture more thoroughly than would be possible outside. The buds are cut with $\frac{1}{2}$ an inch of wood on either side, laid in the ground bud upwards, and completely covered with soil to the depth of $\frac{1}{2}$ an inch. This soil must not be allowed to dry out or become packed or baked on top. When the young plants are sufficiently strong, they may be carefully transplanted to nursery rows, extreme care being taken at all times to prevent any drying out. Ordinary nursery treatment is all then that is required.

Budding and Grafting.—Neither of these practices is resorted to in South Africa to any extent. Propagation of the variety desired by the foregoing method is as a rule so satisfactory that little need exists for propagation by any other means. Yet both budding and grafting of the fig can be successfully done. Ordinary cleft grafting as described in the chapter on that subject is quite successful, if a little extra care is taken. Particular attention should be given to the process of waxing over both the stock and the tips of the scion. Precautions to prevent drying out by evaporation from any exposed surface must be observed and the whole stock may be bound round with ordinary insulation tape as far down as the split extends.

Annular or ring budding is a good method to use in working over young stocks. That also requires to be carefully done. It consists in the removal of a piece of bark about 1 inch wide or even $1\frac{1}{2}$ inches from the stock and substituting in its place a similar-sized piece from the tree of the variety to be propagated. Make two incisions through the bark of the stock right round it, but not into the wood, at the distance required, remove the ring of bark set free by the cut and replace it by another ring carrying a bud from the tree which is to be propagated. This strip of bark should fit into the naked place on the stock as neatly as possible, for that reason it is well to have the branch from which it is taken as nearly as may be the same size as the stock; in all cases, the upper and lower edges of the piece inserted

should come into contact as much as possible with the edges of the bark of the stock. The operation should be carefully and speedily done and the whole bound up with a strip of waxed calico. After about twenty days this may be removed. Annular budding should be done in April and the stock above the bud cut down the following August or September to the usual stub of 4 inches or thereabouts.

Planting Out.—The fig should be planted during July or August, depending on the locality. The distance apart at which the trees should stand may be generally accepted as 25 feet, with exceptions in favour of a greater distance—up to 30 feet in specially favoured areas and a possible reduction to 20 feet in those spots where growth is not as rapid.

Special care must again be taken not to allow any drying out of the roots at planting time. The fig is specially tender just at that period. In all cases, low heading of the trees should be observed, whether they are destined for bearing fruit either for drying or marketing in the green state. By " green " state is meant the ripe fruit as distinct from the dried article, and not the small unripe figs which are used so largely for preserves and crystallising purposes. The trees should not be allowed to get too high, as fruit for drying should be allowed to fall from the tree and too long a drop would be likely to injure it, whilst for convenience of picking a tender fruit like the fig, a low-headed, spreading tree is to be preferred.

Pruning.—The less pruning done on a fig tree the better. Like all trees having a soft pith, it has an aversion to the use of the pruning knife. This does not mean that fig should never be pruned, but that as little as possible should be done.

After establishing the tree with low head and three or four main branches and having trained them to grow in the right direction to allow the tree to attain a symmetrical shape, the only pruning which need be done is the removal of branches which interfere with each other, cutting out the ones growing in the wrong direction close up to the stem from whence it grows and leaving no stub. In order to prevent the trees from getting out of hand as far as height is concerned, an occasional shortening may be done as required, perhaps every other year or even less frequently. As a rule, July is the best month for this work.

Cultivation.—Ordinary cultivation methods are all that are required for the fig. An annual ploughing and the usual cultivating or discing should keep the land in good order. In orchards planted for drying purposes, it is necessary to keep the ground under the trees particularly smooth and clean so that the fallen figs may be injured as little as possible.

Varieties.—The following is a list of varieties stocked by our leading nurserymen. All are improved by caprification, the

White Adriatic especially. The planting of a succession of Capri figs in order to maintain a supply of *Blastophaga* is recommended wherever figs are grown on a fairly large scale, even if they are not required for drying purposes and varieties other than those of the Smyrna type are grown. Disappointment owing to the non-fruiting of different types is by this means overcome.

Adam. One of the best known figs in South Africa and to be found in every province. The tree is a very strong, vigorous and healthy grower, one of the largest we have. Regular and heavy bearer, fruit medium to large in size; shape somewhat pyriform, slightly flattened at the apex; skin brownish; flesh pink to red, sweet and rich flavour. Useful for dessert and preserving purposes. First crop ripens December—January.

Adriatic (White). A very favourite variety all over the world, which has done exceedingly well in most parts of the Union. The tree does not get to be as large as the Adam, but makes a symmetrical, medium-sized tree, and is a good and regular bearer. Fruit is medium to large in size; shape pyriform with flattened apex; skin green until ripening, when it takes on a yellowish-brown tint; flesh pink to red, fine flavour, rich and sweet. One of the best eating figs, improves after caprification. Is also an acceptable variety for drying, but does not equal the figs of the Smyrna type.

Brunswick. Also called by ten other names. Is a favourite fig everywhere. Tree is particularly hardy and a fair bearer of very large fruit. Shape pyriform with unequal sides at the apex; skin greenish-yellow and shaded to brown; flesh opalescent, of extremely rich flavour. A fine dessert fig. Will grow almost everywhere in the Union. Ripens January—February.

Calimyrna. The variety of the Smyrna type of fig, selected and named by Mr. George Roeding, of Fresno, California, as being the best fig for drying purposes and introduced into South Africa as already stated. Tree is of medium size, spreading habit and good bearer; fruit medium to large size; shape extremely flattened pyriform; skin green, getting yellowish as the fruit approaches ripeness; flesh pink, turning to an opalescent amber when ripe; sweet and nutty in flavour. Will do best in the midlands and south-west Karroo, in the Cape, but will grow almost anywhere in South Africa. It is useless to attempt to grow this variety without caprification.

Capri. The wild fig which carries the male flowers, pollen from which fertilises the female flowers of the Smyrna figs when entered by the *Blastophaga*, for which insect the Capri fig trees are a host. Sold in South Africa as Nos. 1, 2, and 3, comprising the Profichi, Mammoni and Mammei varieties, which between the ripening of their different crops provide a home for the insect throughout the

year. The fruit is not edible. The trees attain a large size and are quite ornamental.

Cape White. Called also Old Cape White. A well-known variety at the Cape. Tree a good strong grower attaining a large size; fruit small; shape flattened, roundish; skin green, turning to a light yellowish-brown as it gets ripe. Good for jam purposes, hardly a drying fig from the present-day viewpoint, although formerly it was used for that purpose.

Castle Kennedy. One of the oldest known of English figs, where it is a great favourite. Tree is hardy, a fair grower and abundant bearer. Fruit is one of the largest in size; shape obovate. Skin thin and greenish-yellow in colour at the stem end, turning to pale brown towards the point; flesh opalescent with reddish tinge round the eye, sweet and tender. A good dessert fig. Will grow in any part of South Africa where the temperature does not fall below 20° Fahr.

Col. di Signora Bianca. Tree similar to White Adriatic. Fruit medium size; shape elongated pyriform, showing distinct ribs; skin thick, green, changing as it ripens to yellowish; flesh dark red, sweet and of a delicious flavour. Good for dessert and drying purposes. Does best in the midlands and south-west, also the Western Province of the Cape.

Negro Largo. The favourite large black fig. Tree is a good grower and bearer of very large long black fruit. Shape elongated pyriform, skin black with ribs from point to apex of the fruit; flesh pale red, tender with highly flavoured juice. One of the best figs grown, suitable for eating purposes only. No use for drying. Will grow in most parts of the Union.

Osborne's Prolific. An English variety which has done fairly well in the south-east of the Cape. Tree is not particularly thrifty, but is a heavy bearer of large to very large fruit with long stem and neck and rounded toward the apex; skin varies from green at the stem end to dark brown at the other; flesh perfect opaline, rich and syrupy and of fine flavour. A good dessert fruit.

Panachee alias *The Tiger Fig.* Fruit above medium size, roundish to turbinate, and of good appearance; neck short; skin yellow striped with bands of green, some wide and others narrow; flesh bright rose colour. Tree hardy and found all over the Union.

White Genoa. This rejoices in eleven other names, amongst them White Marseilles. Tree is a moderate grower, and does not reach the size of the White Adriatic, is hardy and a fair bearer. Fruit large, round and flat with short neck; skin green, getting a yellowish-brown shade as it nears ripening. Is an excellent eating fig and good drying variety. Is grown in the Eastern Provinces, but may be found in all parts of the Union.

CHAPTER XIX

FRUITS OF LESSER IMPORTANCE

The Quince

Quinces are found in every province of the Union, so plentiful are they and so well do they thrive that they almost appear to be indigenous to the country. This, however, is not the case, and the introduction of the fruit was undoubtedly due to the early Dutch settlers.

The culture of the quince tree has been quite as much neglected in South Africa as it has in most other parts of the world. Only a few years ago such a thing as an orchard of 10 or even 5 acres of quinces was unheard of. Quinces were and still are largely grown as hedges, and a very good hedge they make; the principal object was the establishment of a good hedge, if it yielded a little fruit so much the better. They were not cultivated principally for the sake of the fruit.

Present-day demand for the quince is not large, the principal uses to which the fruit is put is the making of jelly and for canning purposes; certainly quince jelly is hard to beat and the canned article is not to be despised.

The fruit has been exported in small quantities and has fetched good prices overseas, and there is little doubt but that if larger quantities were sent they would be disposed of at more profitable rates than are to be had in South Africa. Locally the demand for the fruit is largely confined to a sufficient supply for the annual jelly, jam and canning campaign. It has never, as far as the author knows, been dried on a commercial basis. Given the necessary time and trouble it would undoubtedly dry well, but the fruit is difficult to deal with. Most varieties have skins which are covered with fluff or down, which has to be wiped off, then the fruit itself is hard and often woody in texture near the core.

It is largely used for bottling for home use and is a very acceptable addition to the winter store of canned fruits. Every portion of the fruit is utilised, the peel and cores being used for jelly, whilst the fruit itself is bottled or canned.

The quince is very little used for actual eating purposes in an uncooked state, though there are one or two varieties which are

more tender and of better flavour than the rest with which small boys are not above struggling. The tree is but small and has a bushy tendency, and on that account may be planted when set out in orchard form at a distance of 15 feet or thereabouts.

The number of quince orchards in South Africa is but small and these are principally confined to the Western Province of the Cape, where the trees seem to appreciate their surroundings. They thrive best in a good soil. It is generally supposed that the quince will grow almost anywhere and there is no doubt but that it is very accommodating and does its best under all circumstances, but for the production of a strong, healthy tree and fruit of the best quality, good soil should be selected. Another generally accepted idea is that quince trees like to grow in damp situations, and that they prefer soils naturally moist. If planted under such conditions it is very necessary that drainage should be seen to as the roots, although they may like damp soils, do not like standing in water.

Propagation may be either from seeds or cuttings. Probably the large majority of trees in South Africa have been raised by the latter method and although it appears to be quite a satisfactory one, there is little doubt but that a tree grown from seed would have a better root system and be longer lived.

Whichever method is adopted the usual nursery conditions and rules must be followed as in the ordinary way. Cuttings if used should be of 12 or 16 inches long and two-thirds of this should be set in the ground and the other one-third left exposed above, the cutting should be from the thickness of a pencil upwards, perhaps ½ an inch is about the best thickness to use. They may be planted any time after the fall of the leaf, July being as a rule the best month.

After planting out, the little trees are treated just the same as any others such as the apple and pear and cut back to a single stem. The tree is not a quick grower, though probably it is quicker in South Africa than elsewhere, and for that reason it should be winter pruned for the first four years regularly, so as to get it into some decent kind of shape. If this is not done it is likely to degenerate into more of a bush than a tree.

The branches are thin and willowy and require strengthening during the first years of their growth. After that, the pruning of the quince is best either left alone or only practised in moderation. Fruiting is more prolific when but little pruning is done, the tree has a marked tendency to the production of many branches, as if these are left alone a regular thicket is formed. It is advisable, therefore, that pruning should be largely confined to thinning out superfluous branches rather than cutting back the last season's growths. Another reason for this is that the fruiting shoots appear at the ends of the branches, the trees bear on twigs of the present

season's growth, so that if regular cutting back occurs fruit bearing is reduced to a minimum.

When planted in orchard form, cultivation should be practised just as in the case with other fruit trees such as the apple and pear. Deep cultivation is not advisable as the tree is a shallow rooting one, but ordinary clean cultivation should be maintained.

Fertilising the quince has not received much attention here, yet it pays just as well to keep the ground in which the tree is planted in good heart as in the case of other trees. Well rotted stable manure is a most useful application and one to which both tree and fruit always respond.

Varieties.—Boreczi. One of the largest of all varieties; flesh sweet and of good flavour; skin smooth, golden-yellow. Good and early bearer.

Cape Selected. A variety selected from amongst the many types of Cape quinces by Messrs. Pickstone as being amongst the most desirable to plant.

Meech's Prolific. One of the most prolific bearers of medium-sized fruit. Considered one of the best quinces, is a regular and heavy bearer and a good grower.

Orange. One of the oldest varieties under cultivation. Has stood the test of time, shape is rather rounder than some others, is a good fruit of excellent flavour.

Portugal. Another old variety still held in good repute. Unlike the last-mentioned is more of a pear-shaped than round and is a favourite variety to plant.

Pineapple. The best of all quinces for canning and cooking purposes. One of Luther Burbank's productions and introduced by the Transvaal Agricultural Department in 1908. Is a medium to large-sized fruit, something like the orange variety for shape, has the quality when cooked of becoming tender right through, like an apple. The flavour is supposed to resemble that of a pineapple, hence the name.

Rae's Mammoth is amongst the largest of the quince family and first to ripen. The fruit is of good quality, flavour and colour, but not a particularly heavy bearer.

Van Dieman. A large oval-shaped fruit of fine flavour and quality. One of the best all round quinces. Received the Wilder Medal at a meeting of the American Pomological Society in October 1891. A good quince, but not as much of a favourite as some others.

The Granadilla

The purple granadilla (*Passiflora edulis*) is the common one found in so many gardens in South Africa.

It is a native of South America. The plant is easily propagated

from seed, and has been distributed to most of the warmer parts of the world. It grows to perfection in the hotter parts of our country.

The plant is of the vine type, being a strong grower and capable of spreading, when properly grown on a trellis, to a distance of 40 feet or more. The leaves are glossy, and bright green in colour with large lobes. The fruit is purple when ripe and about the size of a 1½ oz. hen's egg. It has the distinction in South Africa of having been the favourite fruit of the late Cecil John Rhodes.

Many people do not appreciate its peculiar flavour, but it has hosts of friends who think and declare that there is nothing like it on earth. The skin is smooth and greenish-purple in colour until it begins to ripen, when the green gives place to deeper purple; the skin may be termed a shell and it is full of small seeds, each enclosed in a covering of juice almost jelly-like in consistency; the whole has a slightly yellowish appearance.

It is eaten in various ways; the epicure takes his in a wine glass with additions of cream and sherry as the palate demands. It may be eaten out of hand with a spoon from the shell, the skin being hard, brittle and shell-like. It is also used in other culinary ways.

The vine may be propagated either by means of seeds or cuttings. The former is the method usually adopted here, though cuttings grow readily enough. Seed may be planted at any time, perhaps the best months are January and February. So readily do they grow that young plants may often be gathered from under old bearing ones which have dropped their fruits. These plants are termed "self-seeded" and bear fruit identical with that of the parent trees.

The granadilla is not particular as to soils, but thrives best in one of good quality and not too heavy a texture. The red sandy loams which are so common (and so good) in South Africa are well adapted to its culture. The vine may be found in all the warmer parts of the Union, but very little attention has been paid to the commercial aspect of growing granadillas. The fruit may be seen in shops and a certain demand exists for it, but its production as a business proposition has not yet received much attention.

Frostless situations should be chosen for its growth as it cannot stand much cold. For commercial culture the vine should be grown on a trellis running from north to south so that both sides may get plenty of sun. Trellises 6 or 7 feet high may be from 10 to 16 feet apart. When the vines are young they are at their best and as a rule produce good crops of fruit for the first four years, after that time they are not often profitable. Manuring may help matters for another year or two, and for this purpose well-rotted stable manure is quite suitable.

Trellises should be strong and well built, as the vine is a rapid

grower and makes a very heavy demand on the strength of its support. The fruit is exported to England in small quantities with fair results; it is questionable if large consignments would pay as well.

The Giant Granadilla.—These are very large fruits of the same family as those commonly grown in South Africa. They have been introduced on a number of occasions from Australia, but being particularly susceptible to cold, have been destroyed by frost. Messrs. H. L. Hall and Sons, of Tomango, Transvaal, and Mr. Leon Ducasse, of Hillarys, Natal, have both succeeded in raising plants—the latter writes as follows:—

"*Perfecta.*—Originally imported from Australia. The fruit is similar in appearance, taste and shape to our common granadilla, it is, however, three times as large, bears well, and is a great acquisition. Imported it three years ago, and found it a vast improvement on the ordinary granadilla.

"*Quadrangularis.*—Fruit is very large, often 9 inches long and 4 inches across, not as good as the others as a fruit, but being very fleshy it makes delicious pies. The fruit when young and green may be used in lieu of vegetable marrow."

There is some demand for this large granadilla in England, but little has so far been exported. Both the last-mentioned kinds are purely tropical fruits and cannot be grown in any but perfectly frostless situations; they are strong and vigorous growers and may be put to climb a tree in lack of suitable trellises.

The Pomegranate

The pomegranate shares with the vine and the fig tree the attention of Biblical writers. All three are mentioned at an early period in the Jewish Chronicle and it is quite easy to surmise from that very fact that the trees must have been comparatively plentiful in Eastern Europe, Asia and Northern Africa.

Where the pomegranate originated it is difficult to say. Some writers have stated it to be indigenous to Persia and others to Southern Asia, in the author's opinion this is purely a matter of conjecture.

The tree grows to perfection in most parts of the Union of South Africa, though it fruits best in the warmer districts. When well grown it may attain a height of 20 to 25 feet, but that is the exception rather than the rule and perhaps most of our pomegranate trees would average about 15 feet in height when planted singly for ornamental purposes in gardens.

The leaves are small, longish, rather dark green in colour and very glossy. The blossoms are as a rule a brilliant red with a waxy appearance, and there are others, of what are termed double flower-

ing varieties, which have flowers, which may be either red and white variegated, or pure white, or pure red; these are not, however, fruiting varieties.

Most of the pomegranates in South Africa are grown as hedges or ornamental trees; as far as the author is aware there are no orchards of pomegranates in the country. They make a good hedge, evergreen in the warmer areas. The habit of the tree is to throw out a good many laterals or side shoots at or near the base of the stem and for hedge purposes there is no objection to this; if the tree is to be grown for the sale of the fruit it will bear, then the stem should be trimmed up clean, so as to encourage and strengthen growth on the upper and fruit-bearing branches.

The fruit as grown in South Africa is exceedingly handsome, being as large as a good-sized orange, the skin is smooth and somewhat leathery with a bright crimson cheek, it is a most striking-looking adjunct to a dinner table and is frequently sold for ornamental purposes. The inside is full of seeds and a pinkish jelly-like juice. The flavour is slightly acid and pleasant to the taste. It cannot, however, be claimed that the pomegranate is a favourite fruit and the commercial demand is limited. In Southern France and other parts of Europe a drink is made from the fruit; it is a seductive soft drink called " Grenadine " and of very pleasant taste.

Pomegranates are to be seen in the fruit shops in season, and they have been exported in small lots with good prices resulting. Propagation may be by means of seeds, cuttings or layers. Trees grown from seeds are like most seedlings, they may vary considerably from the parent plant. Firminger in his " Manual of Gardening " says: " The best plan is to raise seedlings and to graft upon them, when of sufficient height, from trees of a superior kind." This probably represents the usual method of propagation in India last century, and there is no doubt but that the method was successful. It has been shown, however, that the tree can be so readily and successfully raised from cuttings in South Africa that very little propagation is done in any other way. Layers no doubt are made to some extent, but propagation in nurseries is mostly from cuttings. Perhaps if there had been any special need to produce fruit up to a certain standard pedigree trees might have been used to provide scions. As it is, we appear to be so satisfied with the pomegranate we have, just as it is, that we simply take it as it comes. It is a really fine fruit at that.

If grown for the sake of the fruit, soils should be studied. Red, dry, sandy loams are good if water is available; the trees will grow also in heavier soils and thrive, but irrigation is necessary for the production of the finest and best fruits; the tree in the warmer areas is evergreen and so requires water to a greater extent than does a tree of a deciduous nature. On the other hand, it will

thrive under fairly arid conditions, but fruit is likely to be scarce. When some four years old the first fruits may be expected. If planted in orchard form the trees should be set out at 18 feet apart or thereabouts. Pruning is, of course, necessary if the best results are to be obtained. The following remarks are taken from the Bulletin No. 276 of the California Agricultural Experiment Station:—

"To prune intelligently, one must consider the fruiting habit and habit of growth of the tree. The pomegranate is a vigorous grower sending up each year a number of shoots from the root which gives the plant a bush form unless otherwise trained. The fruit is borne terminally on short spurs produced on slow-growing mature wood. This wood bears for several years, but as the tree increases in size it loses its fruiting habit, which is assumed by the younger growth. Little or no fruit is produced in the middle of the tree. Bearing this in mind, it can clearly be seen that a heavy pruning, specially shortening in of the older wood, will greatly reduce the crop for the next two or three years.

"When the tree is planted it should be cut back to a whip stick at about 24 to 30 inches from the ground. As the buds put out and shoots are produced, these should be selected and thinned out to three or five or more scaffold branches, which should be pinched back to make them stocky. These should be spaced some distance apart—the lowest at least 8 or 10 inches from the ground —and symmetrically arranged round the stem. The following winter the scaffold branches should be shortened to about three-fifths of their length. In the spring the new shoots arising from the scaffold branches (primary branches) should be restricted to two or three per limb. The main stem and frame limbs should be kept free from suckers at all times. The aim in pruning when the tree is young is to induce the formation of a stocky, compact framework. This should be accomplished by the end of the second or third year.

"After the framework is established all the growth is left and the tree comes into bearing. From this time to the age of about fifteen to twenty years the tree increases slowly in size and yield. Pruning after the third year should be confined to a regular removal of all sucker growth arising from the roots, and interfering branches as well as dead brush, and an annual thinning out or removal of some of the older branches. This should be done after leaves fall in winter."

It will be noted that the Bulletin in question was written in an area where the tree was deciduous.

Cultivation should be carried on much in the same way as with orchards of a deciduous nature, the land should be kept clean and in a fine tilth during winter and the growth of the summer weeds ploughed under about February in the area of summer rains. If

fertilisation is considered necessary, stable manure may freely be used. The pomegranate will stand a little frost. It is grown in the South of England, in some places in the open. However, it is not wise to subject the tree to less than 24° Fahr. Although we have only two or three varieties in South Africa, there are no fewer than twelve or thirteen mentioned by L. A. Berkmann in "Bailey's Standard Cyclopedia of Horticulture." It is possible that at some future date some of these may be introduced. In November in 1923 the author saw in Covent Garden Market, London, scores of boxes of pomegranates (so-called) which came from Spain and were something like tennis balls for size with skins of drab leather colour with not a sign of a blush on even one of them. They sold at good prices. Had pomegranates such as those we grow in South Africa been available the Spanish product would only have sold with the greatest difficulty.

The Anonas

This family, which consists of a number of closely allied types, is represented chiefly in South Africa by the Custard Apple (*Anona reticulata*). There are in addition, the Sour Sop (*A. muricata*), Sweet Sop (*A. squamosa*) and the Cherimoyer (*A. cherimola*); of these there are but few in the whole of the country.

The custard apple comes from Central and South America, and is found here only in the warmer area such as the south and east coasts, parts of Natal and Cape Province and portions of the bush and low veld of the Transvaal. They are at their best in the latter areas.

The trees reach a height of 20 feet or more and have rather more the habit of a bush than a tree in the manner of growth. The fruit is heart-shaped as a rule, sometimes oval in form and has a peculiarly marked skin, something like that of a tortoise in appearance. Individual specimens may weigh from ½ to 4 or 5 lb. each, or even more. They are full of a creamy white substance something like custard in appearance, hence the English name for the fruit. There are many dark brown seeds not unlike a very small bean in shape.

It is unusual to find the fruit offered for sale on the markets. The total number of trees in the country is but small and, as in the case of the litchi, the crops are sold to people who come and get the fruit fresh from the trees. It should not be allowed to get ripe on the tree as it is in danger of falling off on account of its weight and also of being eaten by bats, which are very fond of it, besides many small birds.

As a rule, young trees are secured from seeds with the usual results. Trees so grown do not come into bearing at an early age, sometimes one may have to wait for seven or eight years or

more. It is possible to produce trees by grafting and budding, the former method is preferred as being most reliable. It is questionable whether there is a single budded custard apple in the country.

The tree will not prove a success in a climate where the temperature falls below 26° Fahr., and that only for a short period of, say, a few hours; continued low temperature would prove fatal. The custard apple is far from being a prolific bearer. This may be due to the lack of pollination, owing to the anthers of the blossoms being immature and therefore not ready to shed their pollen when pistils are receptive, hence some artificial means of pollination must be sought for.

Like other fruits of a more or less tropical nature, the taste for the custard apple is an acquired one and does not appeal to all Europeans.

The cherimoyer was introduced into the Transvaal by Mr. Graham Lawrence, of Barberton, in 1917, from La Paz, Bolivia, South America. Up to the present time, 1927, his two trees have managed to produce one fruit between them. Writing of the cherimoyer, Firminger, in his "Manual of Gardening," quotes Markham as saying:—

> "They have most of the kinds of anonas in India, but the Cherimoyer fruit, the most exquisite of all, has yet to be raised. He who has not tasted the Cherimoyer has yet to learn what fruit is."

Further on he quotes Fenelle as saying:—

> "One European pear or plum is worth all the Cherimoyers in Peru."

This goes to show how opinions differ.

The Sweet Sop and Sour Sop are to be found in Natal, but the cultivation of either or both of them is on a very small scale.

The Guava

The guava is a native of tropical America, but is as much at home in South Africa as it can be anywhere, and is to be found throughout the sub-continent in almost all localities which are not too cold for it. It is distributed over the Cape Province and large portions of the Transvaal and Natal.

The common guava, which has no special name to distinguish it from any other varieties but is just "Guava" to most people, is the one generally found in gardens wherever the fruit is grown.

There are different varieties of this fruit, that most in evidence being about the size and shape of a large egg, the skin is green, changing to a creamy yellow as the fruit ripens. The flesh is

reddish-pink in colour with plenty of small seeds which are quite hard in texture.

The flavour of the fruit, which is very similar in all varieties, is indescribable. As a rule, on first acquaintance the guava is not by any means a favourite, but after becoming accustomed to the smell, the taste is sometimes acquired to an astonishing extent. Some people can eat them out of hand, the majority prefer them stewed, and, when cold, they are usually an acceptable dish. The guavas grown in South Africa may be divided for general purposes into two classes.

The common guava and its varieties, and
The Chinese or " Strawberry " guava.

The common one grows into a tree which may be, according to its manner of training, either an upright or a spreading one. In good soil with a moderate amount of moisture they get to be 20 feet high or more. It will, however, grow and yield crops of fruit on almost any kind of soil. Perhaps it does better on a light sandy loam than on any other. The red soils of the bush veld also produce guavas of very fine quality. The tree will produce satisfactory crops under poor conditions; neglect, lack of water and cultivation seem rather to induce it to put forth special efforts to succeed than to render it weary of life.

Although this statement is perfectly correct, the guava does all the better when planted in suitable soil, with water available as required, and it also responds to cultivation in a most satisfactory manner. There is no difficulty in growing the guava.

Propagation has been conducted almost entirely from seeds, and as is the case with most other fruits, this method is not quite satisfactory. One may select the best samples of fruit from the best and healthiest trees to be found, plant the seeds and the result will be often more or less unsatisfactory.

That method of propagation has been popular because it is the simplest and easiest method of multiplication of the plants. The guava is a difficult tree to handle when it comes to budding and grafting, on account of the bark being almost negligible. It has the thinnest bark of any fruit bearing tree, and on that account greater skill than usual is required. If, therefore, one has a particularly good tree from which it is desired to propagate, the question is one of layers, cuttings and root cuttings.

Layering is so thoroughly understood and generally practised that it is unnecessary to describe it.

Cuttings may be taken from $\frac{1}{4}$ to $\frac{1}{2}$ in. from nearly matured wood, 12 inches long, and planted in a lath or glass-house in light sandy loam, more sand than loam, and with care and bottom warmth such should be ready for planting out in rows in about three or four

months and in their permanent position in a year or a little more.

Cutting the roots of almost any seedling tree results in the springing up of lots of little shoots, which are, of course, the same as the parent tree. As soon as rootlets strong enough to support the little tree are formed, it may be removed with as many of them as possible attached and planted out in nursery form in a frostless situation.

Dividing up roots of ½ inch in thickness into lengths of 6 inches and planting them logitudinally about 2 inches under the ground, which should be kept moist, may also be tried, but the author has had no experience with this means of propagation. It may be added that too much propagation by means of root cuttings is not of any advantage to the parent tree.

The guava succeeds best in a climate entirely free from frost; very slight ones are sufficient to kill back the growths of the preceding year. Occasionally a tree may be cut back to the ground, but it will shoot out and make good, until again killed back from the same cause. The guava is not nearly as hardy as the orange.

The tree is a heavy bearer under suitable conditions; the fruit is in slight demand on local markets and prices realised for fair-sized samples are quite satisfactory, from 2*s*. to 3*s*. 6*d*. for the ordinary 18 × 12 × 4-inch tray is about the usual figure.

No export business has been done nor is any anticipated. The principal use for the fruit here is for making jelly, and guava jelly is hard to beat. There is a demand for guavas at the canneries and jam factories, but such a thing as an orchard of guava trees is not often found in South Africa, the custom being to plant them in rows, sometimes as a windbreak, or merely as a dividing line. Should orchard planting be considered, the trees should not be planted a distance of less than 24 feet apart.

They require little pruning, in any case the less the better, provided they are kept in good shape and the branches not allowed to sag and interfere with cultivation.

An old guava tree may be reconstituted in the same way as a peach tree by cutting off the whole of the top and leaving the framework of the bottom branches not more than a couple of feet in length. In a remarkably short time the tree will have grown out again and a crop of fruit may be gathered sometimes in the second and always in the third year after beheading has taken place.

A guava tree will live under fair conditions to be forty years old and over; of course a good deal depends on the care taken of it and the way it is treated. There are many trees in South Africa over forty years old which still bear good crops annually.

The Chinese Guava, sometimes called the Strawberry Guava, is a much smaller affair both as regards tree and fruit. Frequently it is grown as an ornamental shrub in gardens. The fruit is considered

very suitable for jelly, but is not treated as a marketable product. It will grow under conditions similar to those suitable for the common guava. Both Chinese and ordinary guavas are particularly subject to the attacks of the fruit fly and for that reason should be kept away from large orchards of citrus fruits, or indeed fruits of any kind.

The Loquat

The loquat is indigenous to parts of China and Japan. Popenoe, in his "Manual of Tropical Fruits," states the production of loquats in Japan is estimated at 20,000,000 lb. annually. It is a fruit of great importance there.

It is grown throughout the whole of South Africa and makes a delightful shade tree. In the warmer portions of the country it attains a height of from 30 feet upwards and with its wide-spreading branches and beautiful leaves of glossy dark green has a most inviting appearance on a hot day, more especially when planted on a lawn with a couple of deck chairs, etc., placed under it. As an ornamental and shade tree it has few equals and is really more valued for that purpose in South Africa than for any fruit it may produce.

Yet the loquat tree bears fruit which is highly acceptable and palatable to eat, besides being a source of some profit if properly grown and looked after. Neglect is, however, the usual portion of the loquat and the miserable specimens of the fruit which we see offered for sale sometimes give the impression that loquats are but poor things, all skin and seeds and not worth spending money on.

Given trees of good sorts, brought up decently and in the receipt of only moderate care, the fruit of the loquat becomes an entirely different article. Most loquats in South Africa are just as guavas are guavas, with no name for the different varieties. The late Eustace Pillans, for many years Horticulturist to the Agricultural Department of the Cape, took much interest in the fruit and introduced a large round variety from Madeira superior to anything previously grown in South Africa. In 1906 the Transvaal Horticultural Division introduced the Advance, Victor and Premier varieties from California, and these remain to-day the only named kinds in the country.

Very little interest was or is displayed in them, although all are far superior to anything produced by the ordinary nurseryman. The usual method of reproduction is by means of seeds and if the varieties named could have been reproduced true from seed, they might by this time have been widely distributed.

As it is, budding, grafting or layering is compulsory if any special variety is to be propagated.

Seedling loquats, grown from some strong, healthy tree, make

A FINE SPECIMEN OF LOQUAT TREE AT BREMERSDORP, SWAZILAND.
[*Photo by A. M. Miller.*

suitable stocks for budding or grafting. Mr. C. A. Simmonds, of the Warm Baths Experiment Station, Transvaal, made use of the quince as a stock successfully, but it is not likely that trees worked on that stock (the quince being often only a bush) would attain the same size as those budded on loquats.

Budding the loquat is a simple process, much the same as budding citrus trees, the usual T incision is made and a longer bud than is generally used has been found more successful than those of ordinary size. Grafting may be done and is preferred by some propagators, as buds sometimes hang fire before they start growth.

The fruit is used principally for eating out of hand, but is also made into stews, pies and jellies; the latter are said to be good. Loquat pie, cold, is certainly an appetising dish and with the seeds removed is said very much to resemble cherry pie. The loquats grown in South Africa comprise the following.

Common Seedlings.—These are the largest of all as regards the size of the tree, giving the most shade and the smallest fruit.

Madeira (*Pillans*).—A large round fruit, orange-red in colour, borne in small straggling clusters, 4 seeds.

Advance.—A large-sized fruit, 2½ inches long × 1½ inches across transversely. Shape pyriform; skin yellow and thick; flesh lightish yellow, of pleasant acid flavour, large tight clusters; seeds 4; does not come true from seed, but seedlings of this variety are usually superior to those of the common loquat.

Victor.—Larger than Advance, of similar shape and colour; loose clusters; three or four seeds. Ripens late.

Premier.—A fairly large oval-shaped fruit. Skin thick, deep yellow in colour; flesh light creamy yellow; seeds four or five.

The Date Palm

The date palm is a native of Africa, Arabia and Eastern Asia. It is a tree with a history dating back towards the very earliest periods of which the human race has knowledge. Beloved by all good Mahommedans, a provider of food for the hungry, of wood for building purposes, leaves for thatch, the very staff of life to the descendants of Ishmael, it adds the picturesque touch to many pictures of Eastern life and scenery.

The dried fruits of the date palm which we call "Dates" are popular and in demand all over the world. Present-day Egypt, although a large producer of dates, has to import in order to supply her needs. The demand for the fruit is enormous—it comes from all of the five continents. Major H. C. O'Brien—an old resident of Basra north of the Persian Gulf and south of the spot where the rivers Tigris and Euphrates meet, in the neighbourhood of which some 11,000,000 date palms grow and yield their crop annually—

has described to the author the anxiety felt by and the competition which exists amongst the various exporting firms to secure the first consignment of the new season's fruit (in September) for America. The race across the Atlantic (reminiscent of the China tea clippers' race round the Cape to England last century) between steamers engaged in its transport, in order to be the first home and secure top prices; the huge stacks of Norway pine shooks for making boxes for the shipment of the fruit and the enormous number of people who depend on the date crop for a living.

The date palm is a strikingly handsome tree. It grows to 80 feet high and over and presents a most graceful appearance with its long pinnate leaves, which form its crowning glory. It may bear fruit from the time it is two years old to 200 years or more. The author has seen at Mecca (Cal.) a date palm two years old with a bunch of dates weighing 18 lb. The yield should be regular and continuous and of an average total of some 150 to 200 lb. per tree when fifteen years and over.

The trees are diœcious, like the paw-paw, different trees bearing the male and female flowers; pollination has to take place before perfect fruit can be formed. By diœcious is meant the having male flowers on one tree and female on another. Should this function be left to nature to be accomplished by the wind or by insect life, female blossoms are liable to be infertile and will produce small, imperfect, stoneless fruit. Resort is therefore had to artificial pollination and this has been done by the Arabs for hundreds—possibly thousands—of years. The date is still the most important of foods to large numbers of the population in those parts where the tree has been grown for so many centuries.

Date palms are also to be found in South Africa, America and Australia. In Arizona and California, U.S.A., the culture of the date has made considerable headway and may, in those States, be considered as being in a fair way towards stabilisation.

Within the Union of South Africa, many date palms may be found and fine, handsome, well-grown ones at that. One or perhaps a couple may be seen in a garden in many districts from the Cape to the Northern Transvaal, with the exception of the high veld. Efforts have been made to plant the date palm on a commercial scale. Some years ago, the author supplied some hundreds of young plants to growers in the Upington district, but they have not done too well, from one cause and another. In South West Africa many thousands of date palms were planted under German rule and these also, possibly as a result of the war, have met with neglect and are consequently mostly defunct.

There are, without doubt, many spots within the Union of South Africa where the date palm could be successfully grown. The tree likes plenty of warmth—both by day and by night—and there is a

wide area where such conditions are to be found. It will also stand quite a lot of cold and temperatures of 15° or even less are not likely to do serious injury to the trees unless maintained for some considerable time.

What is an absolute necessity is that the roots of the date palm must have plenty of water. Brack water is almost as much appreciated by the tree as fresh, excepting in the case of young plants, which cannot put up with it to the extent they do when older.

The date palm is accustomed to arid conditions. It flourishes in the cases of the Sahara Desert and would do so just as well if planted under similar circumstances in South Africa.

On the Olifant's River in the Cape between Klaver and Ebenezer, round Prieska and Upington and in parts of the Karroo where the climate can with safety be called " arid," the date palm should be a success, provided that it has ample moisture at its roots, otherwise it will fall. Selection of suitable soil does not seem to be of much importance. The tree will flourish in a light sandy loam, a red loam, and also in a loam with clay sub-soil. Turf soils are not as suitable.

Propagation.—It is quite an easy matter to raise date palms from seed which comes out of perfect fruit. Anyone can plant date stones from the fruit ordinarily sold in the shops with the assurance that the bulk of them will germinate, that is, if they are properly looked after. The male and female trees will be about equally divided. Of course, nothing can be said as to what class of fruit will be borne on the seedling date palm; it is a case of " wait and see."

In order to secure trees of any special variety it is necessary to plant suckers from the particular kind desired. These shoot up from the base and sometimes the sides of the tree and are, therefore, identically the same as the parent plant. There is no such thing as budding and grafting the date palm. As a fact, the use of suckers is the only method resorted to in countries where commercial date planting is carried on in setting out a date plantation.

Suckers may be removed from the parent tree when 3 or 4 inches in diameter. Smaller ones should not be planted. They may be cut half-way through a few days prior to their entire removal and soil heaped up round the base of the tree and kept moist. A large and strong chisel is the best tool to use to separate the sucker from the parent plant. The operation is not a pleasant one, the suckers are hard to get off properly—without a chisel, it is almost impossible. The leaves should be partly removed or at least cut back before any attempt is made to remove the sucker. This is best done by cutting into the heart of the tree obliquely at the base of the sucker on one side and even a little lower than the base, then taking the other side and making a similar cut into the tree to

meet the first. The sucker can then be pulled out and away from the tree and left on the ground for a couple of weeks (just as pine-apple suckers are). During that time it will harden and may afterwards be planted with better chances of success, either directly in a permanent position or under shade for a time. In both cases plenty of water is needed to give the sucker a send-off.

In California, it is customary to plant suckers at a distance of 33 feet apart. Large holes 3 feet wide by 3 feet deep are dug and stable manure placed at the bottom, a foot in depth. Then the hole is filled with soil and saturated with water. In a day or two the sucker is planted and fresh soil added in order to bring the land level. The suckers are planted about 16 inches deep. Thorough soaking with water follows and this may be done by basins round the stem—just the opposite way to watering an orange tree. Summer planting is the best. December or January would appear to be the right months. Constant moisture is necessary and mulches of straw or long grass may be placed round the trees to prevent too rapid evaporation, in addition to ordinary cultivation methods.

Seeing that the planting of suckers is the only assured method of securing the desired variety, the question may be raised, "Why plant seeds in order to raise date palms?" The reason is that owing to the presence of an almost ineradicable scale insect in the date palms of Northern Africa, whence supplies could be most readily drawn, the import of suckers was and still is prohibited in South Africa. The idea was to propagate large numbers of trees and select the best for further reproduction, thus avoiding the possible destruction of any plants at a later date.

It has been said that pollination is necessary for the proper fruiting of the date palm. Mr. Lucius van der Poel, a late assistant of the author, acting under instructions, pollinated the palms on Mr. Chas. Barret's place in Pretoria in 1908. He had never done or seen the work done before, but the result was a good crop of dates from trees which had not previously borne. The work is done by hand; the spathe or sheath containing the blossoms of the male tree is removed as soon as it opens. It is easy to distinguish it from that of the female tree as it is much shorter and has white blossoms whilst those of the females are yellowish. The blossoms may be kept with the pollen in them if the female flowers are not open; they should be kept in a dry and cool place. As soon as the spathes containing the female flowers burst open, a twig bearing male pollen is taken; the blooms in the female spathe are opened out and exposed to the pollen of the male blossoms, which is gently shaken over them. This done once is usually effective, but if rain falls it should be done again. Occasionally the twig which has the male flowers is hung up in the female tree in such a

manner that any pollen falling from it should drop on to the female flowers. The pollen lasts a long time in good condition.

Popenoe in his notes on the date says:—

> "Thoroughly dry pollen will retain its vitality for many years."

It is unusual for all the dates on a bunch to ripen at the same time; some stems will be ripe before others. These may be taken off and the unripe ones left to ripen. As, however, this entails some little trouble, it is customary to cut the bunches off when the majority of the fruits are ripe and hang them up for drying and curing to be completed in some warm and moist place. It may be stated here that a fresh ripe date is supposed to be one of the very choicest of fruits.

The artificial ripening of dates has been tried in California with marked success.

"JACKFRUITS" GROWN IN THE ORCHARDS OF H. L. HALL & SONS, TOMANGO, TRANSVAAL.

The Jackfruit

The jackfruit is one of the largest of fruit-bearing trees. It grows to an immense size in its native home in India and the specimens we have here in South Africa are also fine-looking trees reaching to possibly 40 feet in height, but in India from 60 to 70 feet is mentioned by Popenoe as being possible under favourable conditions.

The leaves are medium to dark green in colour and much resemble those of the laurel for shape and size; they are also bright and glossy in appearance.

The fruit is large, in fact the largest fruit we know. It may measure from 1 foot to 18 inches or more in length by 6 to 8 inches in diameter. It has a rough appearance, being thick and hard, and studded completely over with small, protuberant points. The fruit is carried as a rule close to the trunk of the tree and has a particularly stout stem which is very necessary on account of the weight it has to support.

The jackfruit is very little in demand and as a rule only appears on the tables of some agricultural or horticultural show, where it is regarded more as a curiosity than anything else. It can only be grown in warm climates. Barberton district in the Transvaal

possesses some fine specimens of the tree and seems well suited to its growth. The fruit contains many seeds and these the Indian cooks utilise in the preparation of curries.

In South Africa the fruit has no commercial value to speak of.

The Mulberry

There are three varieties of mulberry which are widely grown in South Africa. They are the Persian, or, as it is often called, the "English Mulberry" (*Morus nigra*).

The White Mulberry (*M. alba*) which is grown principally as food for silkworms in those countries where a silk industry is present, and the Common Black Mulberry (*M. rubra*).

Each of these varieties is found in the different provinces of the Union. All are sufficiently hardy to thrive in any part of South Africa. The tree is deciduous and may grow as in the case of the common black one to 30 feet and over in height, making a handsome tree with wide-spreading branches. It is very quick growing and may be raised in quantities from cuttings with but little trouble.

When young, the leaves of each of these varieties are variable and entirely different from what they become later when the trees are older.

The White Mulberry does not get to be as large as the common one; it is more inclined to grow straight upwards with less spread of branches, whilst the English kind is eccentric in its habits. In some instances, trees of 20 years old or more may be found less than 10 feet in height and others of the same variety at the same age will grow into large handsome trees.

Although the last-mentioned kind is grown for its fruit, there is next to no market for the mulberry, and as a consequence very few trees are seen, hardly ever more than one or two in a garden. The fruit is sweet with a distinct flavour and is much sought after by children. In order to obtain good large trees of this variety it is best to graft the seedlings of the common black one, which are strong growing and should produce vigorous healthy trees.

The White or Silkworm Mulberry is grown almost wholly as food for the silkworm, and of course is most plentiful in those countries where the raising of silkworms is an industry. It may be found in large numbers in the Transvaal, where it was extensively planted some years ago round many of the schools in the country districts, the idea being that the children should be taught to take an interest in silkworm culture and eventually silk production. Many good trees are still to be seen, filling the useful purpose of shade trees in summer, but as far as the author is aware very little silk has yet materialised.

The Common Black, the largest and finest of mulberry trees, is

of little or no use for feeding silkworms and its fruit is not anything like equal to that of the English variety, though occasionally a tree may be found bearing quite a good-sized fruit. It is more acid than the larger sort and makes excellent pies. Children and birds are quite partial to this fruit.

As the tree grows so readily from cuttings, there has in the past been a weakness to plant them as windbreaks round orchards of other fruit trees, including oranges. As this variety proves to be a most satisfactory host to the red scale it should never be seen in the vicinity of a citrus orchard.

The Pawpaw

This fruit, called by many different names in different parts of the world, is a native of Central America and the West Indies, whence it has spread to all tropical countries. It is widely distributed in Africa and is found along both the east and west coasts. In the Union of South Africa, Natal and the low veld of the Transvaal are the principal areas from which any commercial distribution of the fruit is made and this business has sprung up within the last twenty years. The acreage under pawpaws has developed to such an extent in the low veld of the Transvaal that they have a " Pawpaw King " in those parts.

The trees are not long lived and are not considered profitable after having yielded three crops. In Natal and the warmer parts of the country the trees naturally grow upwards with one straight stem and are minus any branches. This is very marked when trees are set out in regular plantation form at 10 or 12 feet apart. When one finds a few trees planted haphazard, branches occur more frequently; as a result the trees remain in bearing a little longer, but the fruits are likely to be smaller. On the whole the single-stemmed trees each with its cluster of fruit are preferable.

The appearance of the trees is not unlike that of palms with the bunches of fruit showing beneath the waving greenery above. The leaves are large, not unlike those of some figs, with large lobes, and have stems up to 2 feet in length. The wood is tender and brittle and so the trees require to be planted in a sheltered position. High winds acting on a tree which may carry a load of fruit of roughly 100 to 200 lb. weight are likely to blow it over. As the trees grow higher the lower leaves fall off, leaving a bare, exposed stem and this adds to the resemblance to the palm.

The pawpaw is what is termed a dicœcious tree ordinarily, though other forms are known. It is customary to raise the trees from seed. Out of 100 seeds perhaps 65 will give male and 35 female plants. The pollination of the latter by the former is effected by insects.

The process of raising plants from seed is of the simplest. Seeds from a ripe pawpaw are planted in boxes or in a specially selected spot for a seed-bed, light sandy soil is the best to plant them in, then in a few weeks the plants are up and when about 6 inches high are ready to be transplanted. Then comes the desire to select the female plants for setting out in plantation form without too many males; as all the plants look alike, this is a most puzzling problem which has still to be solved. At one time it was con-

ONE-YEAR-OLD PAWPAW TREE.
The ordinary type of South African pawpaw.

THE EAST AFRICAN TYPE OF PAWPAW.
These may have either pink or yellow flesh.

sidered fairly safe to remove all the strongest and tallest plants and leave the remainder, the idea being that the stronger ones would be all or nearly all males. This, however, is by no means the case and it may safely be said that the only means of sex determination is afforded when the young trees blossom.

A safe proportion of males to females is one to ten. In order to avoid disappointment the practice of setting out three young trees together is sometimes customary, then the surplus males can be removed at blossoming time. In suitable soil, and under ordinarily

favourable conditions, the trees will fruit within twelve months of planting out.

Propagation of the pawpaw by seeds is general throughout South Africa, and is likely to remain so, as it is the most satisfactory method of reproduction. The tree can be grown from cuttings and it is also possible to graft the plants when they are young. Results from grafting have not proved at all satisfactory in Florida, where this work was undertaken first. Although the actual grafting was easily accomplished the trees appeared to deteriorate both as to growth and fruit-bearing capacity. There appears, therefore, no necessity to go in for grafting the pawpaw.

Although dicœcious pawpaws predominate in South Africa, there are also hermaphrodite forms which have perfect flowers and produce fruit as good as that borne on the ordinary trees. There are also other forms which arise under certain circumstances with imperfect combinations of staminate and pistillate flowers on the same tree; as a result small and generally imperfect fruits appear. The usual distance at which the trees are planted is about 12 feet apart in squares. They are also set out in rows 15 feet apart with the trees 10 feet apart in the row.

Climate.—The pawpaw will not stand more than one or two degrees of frost without damage. It is best, therefore, to plant them in a frostless zone. Very slight frosts cause the leaves to wither and in the Waterberg district of the Transvaal a temperature of 25° Fahr. has been sufficient to prove fatal to the fruit. The tree seems to be at home in a dry atmosphere and provided it has a moderate supply of water (far less than an orange needs) and good drainage, it is at its best under such conditions. The plants after being set out in their permanent places require water in the early stages once every ten days or so, depending on the climate and rainfall. If the atmosphere is dry and evaporation rapid they will naturally require more than when growing in a moist climate. When the trees are six months old and well away towards the production of their first crop, water should be given once in three weeks or thereabouts. Pawpaws *are* grown without any water except that which falls in the shape of rain, under such conditions the fruit is neither as large nor as plentiful as when the tree is properly watered.

Soil.—If other conditions are suitable, principally climate and water supply, the pawpaw will grow in almost any kind of soil, provided it is moderately loose and dry. On wet and damp soils it is not likely to make a success, drainage is therefore essential even on soils naturally dry. The red sandy loams of the Transvaal bush veld seem very suitable for the growth of the pawpaw. Sandy soils on the Natal coast line and heavier types inland also produce good pawpaws. Probably the red sandy loams produce the best both as to trees and fruit.

As the yield of fruit per tree is extremely heavy, amounting to from 60 to 80 lb. weight of fruit or more the first year and increasing afterwards, the demand on the soil is considerable and fertilisers may be used with advantage. Rotted kraal or stable manure may be applied freely. Blood meal and sulphate of potash in equal proportions with 1 lb. of bone meal added up to 5 lb. in all may be applied to a two-year-old tree. The result is apparent in the size of the fruits which will measure up to 20 inches long in the water melon-shaped varieties.

Thinning and Pruning.—The fruit clusters round the stems of the female trees and when pollination has been perfect very large quantities are set. In order to secure perfect specimens it is therefore necessary to remove fully half of the young fruits when they are quite small; if left until they are half grown it is most difficult to get them off the tree and many are injured and others destroyed. Even after quite half the fruit has been pulled off, those remaining will grow together very closely and sometimes force each other out of shape. Thinning, therefore, pays.

Pruning pure and simple is very seldom done. If a tree should send out lateral branches, they may be removed if considered unnecessary. The pawpaw is a remarkable tree in many ways and a pruning to which it is sometimes subjected is the removal of the entire head of the tree down to a height of about 3 feet. This is only practised on male trees and the object is to alter their sex to make them into female trees. Popenoe, in his " Tropical Fruits," says Mr. M. J. Iorns of Porto Rico, who studied this question there, reached the conclusion that other conditions besides the loss of the terminal bud must be present to induce a change of sex, and he suggested the trees may pass through definite cycles of development and be subject to the change only at certain periods. L. B. Kulkarni, in the *Magazine* of the Poona Agricultural College (India) 1, 1915, says he came to the belief that change of sex is not in any way connected with the removal of the terminal bud. He found that male plants in the course of their development may present a number of different sex combinations, as follows:—

(1) Staminate (male) flowers only.
(2) Staminate, with a few hermaphrodite flowers.
(3) A few staminate, with many hermaphrodite flowers.
(4) A few staminate, with many hermaphrodite and a few pistillate (female) flowers.
(5) Hermaphrodite flowers only.
(6) Hermaphrodite with a few pistillate flowers.
(7) A few hermaphrodite, with many pistillate flowers.
(8) Pistillate flowers only.

Thus the plant in the course of its life-history may change from a staminate to a hermaphrodite and then to a pure pistillate.

The fruit of the pawpaw may be either roundish oblong or long round, the latter having the shape and when very large the appearance of a water melon. The ordinary or common varieties mostly grown in both Natal and the Transvaal are the first mentioned and these are of an excellent flavour, the longer ones may have either yellow or pink flesh and are becoming favourites on account of their size and shape, though the flavour is no better than that of the others. The flesh is from $\frac{3}{4}$ to $1\frac{1}{2}$ inches in thickness, sometimes more. To be fully appreciated it should be eaten with the juice of either orange or lemon.

The fruit is considered particularly wholesome and digestible. Papain, which is the active principle contained in the pawpaw, is used in medical practice much as pepsin is, and in dental as a solvent. Papain is an article of commerce and finds a market in both Europe and America. It is prepared from the milky juice of the fruit and this is obtained by scoring the rind and allowing the juice to flow. It is collected in the West Indies by natives in shallow shells, dried in the sun and sent away. The production and handling of the dried juice can only be undertaken with an extremely cheap class of labour, much lower paid than is usually to be had in South Africa.

Not only does the tree yield a fruit which supplies aids to digestion, but leaves also, which have similar properties and tough steak may be rendered eatable by being wrapped in pawpaw leaves for a few hours.

So far local consumption has accounted for all the pawpaws produced in South Africa. They are, as a rule, packed in the cheapest boxes or crates obtainable, merula wood being often employed for the purpose. Packing material employed is usually a little long grass. They may be and are shipped all over South Africa and hold up well as far as Cape Town. No export has taken place, but it is understood that sample consignments have been sent away. The fruit is difficult to handle for long distance shipments; it is both soft and heavy. It has no thick skin to protect it and the few lots which the author has seen arrive in London have been in a rotten condition.

The diseases of the pawpaw are fortunately few. It is subject to attacks of scale occasionally, but not of a serious nature. Birds seem to be the worst enemies, as they are fond of the fruit and never miss the chance of a feast.

Note.—Since the foregoing was written, the author has successfully exported pawpaws to England after treating them with a preservative.—R.A.D.

The Persimmon

The persimmons which are cultivated in South Africa are indigenous to Japan. They are often termed "Japanese Persimmons." We have an indigenous variety here of the same family, but it is without interest from a horticultural point of view.

The persimmon is one of the most universally grown fruits in the Japanese Empire. The dried article is greatly in demand and is a commercial commodity of much importance.

The fruit has not become widely distributed until within comparatively recent years, a fact which may be readily understood by anyone conversant with Japanese history. In Europe it is chiefly found along the shores of the Mediterranean Sea, in America it is grown over a wide-spread area reaching from the State of Florida in the south-east to California in the west and embracing the entire cotton belt.

In Australia the fruit is also well distributed, and here in our own country it is found thriving at the Cape, in Natal and the Transvaal. It is hard to say exactly when the first persimmon was introduced. Mr. Costa, an Italian nurseryman at Newlands, Central Province, has done a great deal to create interest in the fruit and has certainly done more to popularise it than any other nurseryman in South Africa.

The author found in 1902 some of the finest persimmons he had ever seen, growing in the garden of the late Mr. Johann Rissik at Arcadia, Pretoria. The trees must then have been about eight years old. It is safe to say that the first persimmons were brought to South Africa at the close of the last century. The tree is found in all the warmer parts of the country, principally in individual gardens. There is no large plantation of persimmons, that perhaps is because the fruit, although it has a most attractive appearance, has not yet become really popular. It has not been exported, and although there is no reason why trial shipments should not have been made, it has not so far been done. Up to the present it may be said that the persimmon is not everybody's fruit.

The usual colour is some shade of yellow and it may run from a lightish shade to a fairly dark red, depending on the variety. The shape also varies from flattish and tomato-like to round like an orange, and some of the best kinds are more like an oblong with a point. They are an extraordinarily fine-looking fruit and frequently weigh over $\frac{1}{4}$ lb. each.

The flesh when the fruit is ripe is soft, almost resembling a jelly, sweet, and may be eaten with a spoon, though there are some varieties which may, owing to the consistency of the flesh being somewhat harder, be eaten out of hand like an apple. The fruit

as it hangs on the tree looks ripe some time before it really is so. If one eats it at this period it is not likely that the persimmon will become a favourite fruit as the astringency is extreme, almost sufficiently so to tie one's tongue in a knot. If picked and stored (say on the pantry shelf) until ripe, the fruit will be found to resemble nothing as much as a bag of jelly and in this condition a spoon is indicated. The astringency is lost and the fruit has a flavour which has been described by some as something between an apricot and a tomato and by others as between a strawberry and a ripe Japanese plum.

The fruit may be divided into two different classes, flattish and roundish oblong. Many of the former are light yellow in colour whilst the latter are often from dark yellow to orange-red. The latter are the handsomer fruit and fetch the higher prices.

Most varieties here are seedless, due doubtless to lack of pollination. Many flowers drop without setting fruit and the loss of large quantities of the crop from this cause may be safely set down to the lack of staminate blossoms. Tane Nashi, one of the very best varieties, is self-fertile, according to L. H. Bailey, and has seeds. Work of an experimental nature at Warm Baths showed the advantage of planting a mixed lot of varieties each in a separate row, crops being heavy and regular.

The tree will grow almost anywhere along the coastal belt and in the warmer situations in the interior. It will not stand too cold a climate, possibly a mean temperature of about 60° Fahr. suits it best.

In California, the author has seen a heavy crop of ripening persimmons in December, without a leaf on the tree, with hoar frost on the ground in the early morning. A striking and beautiful sight, and it is usual for the trees so to bear in that particular valley of Santa Clara, just 40 miles south of San Francisco. Most of the varieties ripen there between October and December. In the Transvaal the fruit is at its best from March to May, depending on the variety. Unlike the habit it has in California, the fruit is ripe and ready to gather before the fall of the leaf. Prior to that the trees become a blaze of green, orange and red, owing to the colouring of the leaves before falling.

The persimmon is not a large tree. At twelve years of age, some few might reach 12 feet in height, depending on the variety, but the majority would be probably not over 10 feet. The leaves are broad and long, bright and glossy, and altogether the tree may be almost regarded as an ornamental one and especially so at the period just mentioned. If planted in the usual orchard formation a distance of 18 feet apart would be ample.

Soils.—The persimmon will thrive in a large variety of soils, but does not do well in damp places. The best and most suitable

ones which have come under the notice of the author are the deep red loams of the Transvaal bush veld; they appear to suit the tree better than any others. Almost the only failures which have been noticed in the Transvaal have been in a light granitic sandy loam in the low veld and here, despite repeated efforts, no success has been met with.

Irrigation is not a necessity for the well-being of the tree providing there is a fair rainfall, but at blossoming time or a little earlier, and also when the fruit is half grown, a little water is beneficial.

Propagation.—This is usually done by the budding or grafting of seedling trees. When these are not procurable locally, seed is imported and seedlings are raised. Trees originating by that method may be treated in the same way as other seedlings. Seeds are sown in seed beds, and when the resulting plants are big enough they may be moved to nursery rows and treated in the usual way. Desirable varieties are multiplied either by means of budding or grafting and no particular difficulty is experienced in getting a good "take."

There is no very large demand for persimmons in the shops. Like other fruits, the supply of nice-looking good quality ripe specimens creates demand. Persimmons are usually put up for market in the standard export box measuring $18 \times 12 \times 3$ or 4 inches deep, as required, and the value of such a box is from 3*s.* to 4*s.* 6*d.*, depending on the condition, appearance and variety of the fruit.

Varieties grown in South Africa and tested at the Warm Baths Experimental Station are as follows: Tane Nashi, Hyakuma, Hachiya, Among or Yemon.

Tane Nashi.—A very large, pointed, conical-shaped fruit, about $3\frac{1}{2}$ inches long and $3\frac{1}{4}$ inches in diameter when cut across transversely; skin, beautifully smooth and orange-red when ripe; flesh yellow and without seeds, one of the best varieties.

Hyakuma.—Size very large, rounder than Tane Nashi, not quite as long but also with a point, though not so marked; skin light yellow with indentations at the apex; flesh dark with very little astringency. This variety may be eaten out of hand.

Hachiya.—One of the largest of all persimmon trees with fruit of a most attractive appearance. Shape oblong to conical, running to a decided point: skin dark orange-red; flesh medium yellow, unfit to eat until quite ripe.

Among or Yemon.—A flat variety, much resembling a tomato for shape, which is uneven and more or less square. Skin light yellow, getting darker as it approaches ripeness; flesh yellow, not astringent when soft and nearly ripe. The best of the flat varieties.

The above are considered among the best and are the only ones of which the author has personal knowledge. Mr. Costa, of Newlands, stocked the following, which he briefly describes:—

Tipo.—Beautiful fruit, similar in colour to the orange.

Guibochi.—A beautiful variety, with oblong fruit and red flesh of a fine flavour and perfume.

Isouromarau.—Medium size, bearing in abundance; good flavour.

Lycopersicum.—" Kuro Koki " of the Japanese, a very large fruit and is highly recommended.

Mazeli.—Persimmon of Mazel; fruit globular, brilliant orange-yellow; flesh juicy and liquid.

Ochirochaki.—Medium oblong fruit; flesh dark red, sugary and half melting.

Sokoumiatan.—Fruit medium; sweet flesh; remarkable bearer.

Tiodemon.—Large fruit; flesh sugary and consistent—a new variety.

CHAPTER XX

THE MANGO

Just as the apple in England, America and other countries in the temperate zone of the Northern Hemisphere is termed " The King of Fruits," so, in India, the mango rejoices in the same appellation.

The mango is a native of India and some of the islands of the Malayan Archipelago, possibly also of Mauritius. The tree is an evergreen, and in its uncultivated state attains noble proportions and is of strikingly handsome appearance. It assumes naturally a shape of perfect symmetry, whether with lofty oak-like head or lower and more spreading branches, affording welcome shade to the weary traveller. Numbers of Indian villages have mango trees planted on their outskirts and mango topes, or small plantations, have been planted, often by rich men as thank-offerings for the granting of some prayer or other, such as the birth of a son and so on.

Popenoe, in his " Manual of Tropical and Sub-tropical Fruits," quotes Alphonse De Candolle as saying he considered it probable that the mango could be included among the fruits which have been cultivated by man for 4000 years. Its prominence in Indian mythology and religious observance leaves no doubt as to its antiquity, whilst its economic importance in ancient times is suggested by one of the Sanskrit names, " Am," which has an alternative meaning of provisions or victuals. He also states that Akbar, the Mogul Emperor who reigned in Northern India from 1556 to 1605, planted near Darbhanga an orchard of 100,000 trees. Nothing perhaps more eloquently attests the importance of this fruit and the esteem in which it has long been held than this immense planting, made at a time when large orchards of fruit trees were almost unknown. Three hundred years after they were set out, the English horticulturist, Charles Maries, found some of the trees still in vigorous condition.

Hamilton, who wrote in 1727, declares " The Goa mango is reckoned the largest and most delicious to the taste of any in the world and, I may add, the wholesomest and best-tasted fruit of any in the world."

The mango does not appear to have been widely distributed until the Indian ports became opened to world commerce, but the

tree is now found in almost every tropical country. Without doubt, it was introduced into East Africa by the Portuguese and at a later date both from India and Mauritius, as well as the neighbouring Portuguese territories, into South Africa. Natal was from its geographical position naturally the first province in the Union to introduce the mango. Mr. Leon Ducasse, a pioneer fruit grower and nurseryman, of Hillarys, near Durban, writes:

> " I came to Durban in 1875. There was then at the foot of the Berea a field of mangoes mostly of the common stringy kinds, such as the Long Red, known as the Carrot Mango and Kidney Red. These were then in bearing and must have been at least ten years old, judging from their size. Most of our mangoes came from Mauritius, but some have been imported from India. There are a number of mangoes grown from seeds imported from Mauritius resulting from hybridisation there as the fruits they produce are not known in Mauritius—in other words, they were chance seedlings."

Numerous importations of varieties of mangoes have been made from India and Ceylon during the past twenty-five years, by both Government Departments and private individuals. Probably the greatest amount of success has been met with by Mr. H. L. Hall, of Tomango, Nelspruit, Transvaal. He has included the word mango in the name of his farm.

Mango Districts.—Some of the best mango districts are to be found along the south and east coastal districts of Natal and the Eastern Province of the Cape, where frosts do not occur. Inland, the mango succeeds in some few districts of the Transvaal, viz., Barberton, Lydenburg, Pietersburg and Zoutpansberg. There may be a few warm spots in the Waterburg and Rustenburg districts where an occasional mango tree is to be found, but for commercial plantings the districts named are the only ones to be considered, away from the sea.

The conditions of climate existing at the coast are ideal for the growth of the tree. Travellers to Europe by the east coast route will no doubt recollect the very fine mango trees to be found at various stopping places, especially at Mombasa. Most of them may be classed as " uncultivated." There are many fine trees in Natal, though perhaps not as large as the last mentioned. However, the Natal mangoes are all of cultivated varieties and so should not be compared with the wild trees nearer the Equator.

The Natal growers have many fine varieties of the fruit which seem to be quite at home in their surroundings.

The atmosphere is naturally moist near the coast and entirely different from that which exists in the best Indian mango districts

where, far from being moist, the air is, during the summer months, noted for its dryness. It is claimed that mangoes grown under such conditions are superior in size, quality and flavour to those produced, let us say, at Mauritius, where conditions more nearly approach those in Natal. Inland, in the Transvaal mango districts, there is a distinctly wet and an equally well-defined dry season, and it is plainly manifest that the mango fully appreciates its surroundings. Exceedingly fine trees are to be found, the majority in the Barberton area, but there are others equally good, planted by the author at the old Government Tzaneen Estate in 1908. Barbertonians claim that they grow the best mangoes in

MANGO ORCHARD, H. L. HALL & SONS, TOMANGO, TRANSVAAL.

Africa. Their fruit is certainly amongst the very best the author has tasted; they have some of the best varieties and they take as much pains in the cultivation and give as much attention to their trees as any growers in the Union.

Climate and Altitude.—The limit at which the tree can be grown with some chance of success is just under 4000 feet. At Warm Baths and Potgietersrust in the Waterberg district of the Transvaal, just south of the Pietersburg area at altitudes of 3800 and 3900 feet, respectively, the mango will, in a favourable season give good and satisfactory crops. However, occasionally the crop is destroyed by frost; the trees may be cut down to the ground in an extra severe cold snap, but will grow up again if not damaged too severely and start fruiting in two or three years' time.

Barberton, 2900 feet, and Tzaneen, 2400 feet, show better results. The trees thrive exceedingly and frosts are almost unknown. Most of the Natal and south coast mangoes are planted at about these or lower altitudes and are frost-free. The effect of frost on the mango tree is immediately visible, the leaves turn brown and wither, and the trees present a very woebegone appearance. Even a fall of temperature to 32° Fahr. is sufficient to injure the leaves; 28° is sufficient to kill every leaf on the trees, whilst 23° may possibly be fatal to a full-grown tree. Under these circumstances, it is unwise to plant in any situation other than one where frost is only known to come very occasionally indeed, and then of an extremely light nature or, better still, plant where no frost has ever been known.

Rainfall along the coastal districts is as a rule ample for the requirements of the tree, whilst precipitation in the inland mango areas is about the same, from 30 to 50 inches per annum. The wet season throughout the mango districts is at the period of the year when the fruit is ripening or ripe, and though this may not always be for the benefit of the fruit itself, it is far more satisfactory to have it then than when the trees are in bloom.

Windy situations are as objectionable to the mango as to most other fruit trees, and though it is not as subject to damage from that quarter as some others, it is just as well to select a place where there is little wind. Electric storms are not as common along the coastal belt and in the low country of the Transvaal as in other parts and the question of avoiding hail belts scarcely crops up when selecting ground for mangoes.

Soils and Exposures.—The mango will thrive in a great variety of soils. Climate seems to be of most importance. Provided a soil is deep, loose and well drained, the mango appears able to get a living. At Tomango, in the Transvaal, it is to be found growing to perfection in a light, sandy, rather poor soil, but having considerable depth, and this seems to suit the trees quite well. They are healthy and thrifty and bear good crops of fruit. The land lies on a slope and drainage is perfect. In 1923 a crop of 6000 boxes was taken from this orchard.

At Barberton the trees are planted in a light, red, decomposed granite soil of great depth. At Tzaneen in a medium, reddish, sandy loam, also very deep, the trees do well on both soils, probably better on the last named. All of them are deficient in humus.

Natal soils planted to mangoes vary from light reddish loams to an almost black one with considerable humus. In most instances the trees are planted on a slope. The land is of good texture and quality, and drainage is also good.

Waterberg soils are distinctly good red loams, of the stamp so common to the bush veld of the Transvaal. All these different

soils seem to suit the mango very well. It is a deep rooting tree, and therefore to plant it in shallow soil would be a mistake. Loose, easily permeable soils with good drainage facilities should be sought for when a mango orchard is contemplated. Naturally, low-lying situations with liability to hold moisture are to be avoided.

The soil constituents removed by the mango consist principally of potash, next phosphoric acid, nitrogen and lime. Little experience is available as to the best methods of fertilising in South Africa, but the constituents removed must be replaced; it is possible to assume that something in the way of a complete fertiliser is required. There do not appear to be any specially prepared manures for the mango. It is certain that the supply of wood ashes from home fires will always be welcome, seeing that potash is the most important constituent. Probably the following would be as good a mixture as could be adopted for full bearing trees. Dried blood, 200 lb.; ground bone, 300 lb.; sulphate of potash, 400 lb. per acre.

Propagation.—By far the greater portion of the mango trees in South Africa are seedlings. In many instances the trees so produced bear fruit very strikingly similar to that of the parent tree. It is, in fact, difficult to detect any difference at all in some instances, yet, generally speaking, a slight difference does exist, and it is unsafe to rely upon seeds to reproduce a true replica of their mother tree.

Mr. Leon Ducasse (previously mentioned), in writing February 2nd, 1925, says:—

> "You will probably know, but it is a fact known to very few people, that 99 per cent. of the mango seeds contain two scarabs, a little beetle, black, which must be admitted at a very early stage of the growth of the fruit, for the most careful examination has never betrayed their presence through the hard shell in the fine paper-like membrane covering the kernel. Anyway, there they are, feeding on the kernel and unless removed as soon as the fruit is ripe, they eat the germs and are the cause of failure of the seed to grow. Some people have an idea that mangoes can be faithfully reproduced from seed, this is not the case. I have proved it. They are liable to be hybridised by insects."

Mango seeds, when planted, often produce two or more plants. They are polyembryonic; these, when allowed to grow, may give fruit identically the same, but it may or may not resemble that borne by the parent tree. It has been stated that when four or five little trees grow from one seed, that the fruit, when it comes, will

resemble that of the parent tree more closely than if only one tree had grown from the seed.

It may safely be determined that it is unsafe to plant trees grown from seeds if the object is to secure a uniform standard of fruit, and resort must be made to vegetative methods of propagation, *i.e.*, either by budding or inarching. Practically all the cultivated sorts of mangoes grown in India are the result of inarching, a practice which the Indian gardener thoroughly understands. The method has been in use from time immemorial. It is peculiarly an Indian method of doing things, and requires time, skill, foresight and plenty of patience.

The practice is as follows:—

Seeds of good, strong growing mangoes are planted in small-sized earthen pots, say of 6 inches diameter, called in England 32's, and allowed to grow until they have become the size of an ordinary lead pencil, 6 or 8 inches from the soil, in the pot. The best time to plant the seed is just after it is taken from the ripe fruit. When the correct size has been reached, a platform stand is set up under the tree the variety of which is to be propagated, so as to bring the young pot plant in convenient position near to a small branch on the tree of about the same thickness as the stock. A piece of the bark and wood of the stock is sliced off about 2 to 3 inches in length by a clean cut. A similar piece is taken from the bark of the tree which has been selected for propagation, the two cut surfaces are brought together and tied in position with raffia. The edges of the cuts should meet as near as possible. The inarch is then covered with grafting wax, and in about sixty days the union should be complete. The soil in the pot must be kept damp but not wet. The top of the seedling is removed just above the inarch and the scion is severed from the tree just below. Then the seedling has the scion of the desired variety as its head. On removing the pot from the platform, it should be placed in the shade and given water occasionally. The pot, not being by any means a large one, is unable to contain the rapidly growing roots of the young tree, which should therefore be planted out and carefully staked as soon as the appearance of the union seems to warrant it. Probably the best time of the year to undertake this kind of work is in July or August.

Budding the mango is, when one gets accustomed to it, a quite satisfactory method of multiplying any particular variety. It may not at first be as satisfactory as the inarching method to a beginner, but that is largely a matter of getting accustomed to the right stage at which to undertake the work and the condition of buds and stocks. For commercial propagation, budding is undoubtedly the best method to adopt.

The selection of seeds for stocks should be made from some tree of outstanding vitality and growth. They may be planted out in their eventual position in the nursery rows, or in boxes, for removal after germination. They are ready just about the same time for budding as they are for inarching, *i.e.*, about the size of a pencil or a little thicker.

The selection of buds is important. They must be taken from the smaller branches of the parent tree when just on the point of flushing; the stocks should be in the same condition, and for this reason it is well to have the mango nursery near the orchard. With buds and stocks in a similar condition of vegetation, the actual budding is simple, being exactly the same as in the case of citrus trees. Mr. J. E. Higgins, of the U.S. Department of Agriculture, now stationed in the Philippines, mentions budding into wood 3 inches in diameter. Incisions into the bark of the stock are made up to 6 inches in length and buds 3 inches long are used—otherwise the operation is similar to ordinary budding.

Top Working the Mango.—It may be considered desirable to work over certain trees bearing varieties which are no longer in demand or which have never been altogether acceptable. There are always favourite varieties of mangoes, just as there are of other fruits, and so the approved methods of top working are given. They are much the same as for the orange, except that the use of the " bark " graft is insisted on and the branches are not all cut off at the same time prior to grafting. Those to the south-west should be left and attended to after those put in on the cut branches have grown out and can afford a certain amount of shade.

The grafts grow quickly and bear fruit in a couple of years. The " bark " graft is described in the chapter on budding and grafting. The scions used should be about 4 or 5 inches long, the thickness of a pencil, and taken from the tip of a well-matured branch. The stock may be either large or small; if large, then more grafts than one may be used, but not more than two. The stock must be just in the right condition, *i.e.*, just prior to flushing.

After insertion, the grafts may be tied in with soft string or raffia and covered with oiled paper or some other suitable material. After a month they may be exposed and should be, by that time, on the verge of starting to grow. Another method is that which is mostly resorted to in the top working of the orange. The main branches of the tree are cut off to within 18 inches of the fork—the remaining stumps are waxed over at the ends and the trunk of the tree then whitewashed and the buds inserted into the new growths, when they get to be big enough, *i.e.*, pencil size or larger.

Planting.—Holes should be dug in the ordinary way as for other trees—2 × 2 feet deep is quite large enough. It is not customary

in South Africa to apply fertilisers at planting time, although this is sometimes done in Florida and other mango-growing countries. Trees purchased from a nursery should be about 3 feet high with straight stems, and the habit of growth whether upright or spreading should be known beforehand, so as to be able to decide on the best distance apart to plant them. After planting, watering is necessary. Staking the inarched trees has already been mentioned, and shade may be provided if planting takes place in very hot weather by the use of long grass round the stems of the plants.

The trees may be planted in frostless situations at any time. Summer planting is customary in the Transvaal, after the first flush is well over. Trees may also be successfully set out in early spring before the first flush has occurred. The word " flush " is used instead of growth, it is generally used when speaking of the mango. When the flushes occur, the appearance of the tree is changed from green to ruddy wine colour owing to the exquisite tinting of the young growth.

Square planting is the best, and as the tree grows to such a large size plenty of room must be allowed in which to develop. Thirty feet is the nearest distance at which the trees should be set out and, in the wide-spreading varieties, 35 or even 40 feet is none too much.

Irrigation and Cultivation.—After the watering at planting time it is necessary to irrigate the young trees at intervals of about a month —if no rain falls. During the wet season this may not be necessary, and at the end of the first year water should not be given at more frequent intervals than once in two months. Gradually as the trees attain age and size and their roots begin to go deep down for moisture the need of water becomes less, and this is particularly the case when the soil is maintained in a thoroughly good state of cultivation, and a mulch of 3 or 4 inches of earth provided. In any case, when the mango is once well established and in the enjoyment of good cultivation and a rainfall of from 30 to 50 inches, as most of ours are, irrigation is not a matter of pressing importance, such as is the case with the orange and avocado. It is quite possible for a tree to go on from year to year with no artificial irrigation —but it is always well to be able to give water when the trees need it, either from shortage of rainfall or the extra drain caused by a very large crop.

Local Markets.—Mangoes are packed in the ordinary trays to which South Africa is now accustomed. They usually have a little wood wool with them to prevent shaking about and bruising. A tray will contain anything from 18 to 36 mangoes—according to the variety. All trays are of one size, that is, 18 × 12 inches, but the depth varies with the size of the fruit. Mango export will be dealt with elsewhere.

Diseases.—What is known throughout Natal and the Transvaal as " Black Spot " is the greatest trouble which the mango grower has to face. Very little is known as to any definite means of control. Dr. Ethel Doidge has put in lots of time and work in the endeavour to get to the bottom of this trouble, but so far without any satisfactory results. Constant spraying with Bordeaux mixture from the period before the opening of the blossoms until within a month of the ripening of the fruit seems to help to some extent. Some seasons are worse than others. Often it is more prevalent in Natal than in the Transvaal. All sorts of devices have been resorted to by growers to prevent this disease, which is so disfiguring to the fruit as to render it largely unsaleable. Clean cultivation has been allowed to go by the board and grass and weeds have been permitted to grow. One grower states that he burnt off such a crop and the following season had no black spots. The remedy in the long run might be worse than the disease. The fruit fly also attacks the mango. The best way to control that pest is by the thorough use of the well-known Mally Fruit Fly Remedy.

Varieties.—The old description of the mango, " string steeped in turpentine," is fast becoming obsolete. The cultivated varieties which we are now growing have none of the turpentine flavour about them, and what " string " there is can only be found round the pit. Selection and crossing have been able to produce fruits with scarcely any of the surplus fibre and of delicious and indescribable flavour. Some say the flavour of a choice mango is a mixture of apricot and pineapple. Others say strawberry and pineapple. The flavour of mangoes is, in the opinion of the author, unique.

Discussing the question of varieties recently with Dr. H. L. Webber of California, that gentleman advanced the idea that we in South Africa had not as good-flavoured mangoes as are to be found in some other countries, especially India. He particularly mentioned the Alphonse and Mulgoba. The former has been imported into South Africa on at least three occasions, but the latter, generally recognised as one of the best mangoes, has still to be introduced.

Those we have here to-day, with the exception of Mr. Ducasse's list, are without any official nomenclature. By common consent, they have been given names by growers which, as a rule, have some bearing either on the appearance or shape of the fruit.

The Peach Mango.—The Peach mango is of large size, being some 4 inches long, occasionally longer, by about 3 inches wide; shape oblong ovate; slightly flattened; skin clear apricot-yellow shaded to pink and deeper red; flesh dark apricot, approaching orange. Texture tender, free from fibre; delicious flavour. Ripens February and March.

The Sabre.—The Sabre is large size, 4 to 5 inches long, sometimes longer, by 2 to $2\frac{1}{2}$ inches wide. Pointed at each end and sabre-shaped; skin dark green shading to yellow and bright red, a very handsome fruit; flesh orange-yellow; texture almost fibreless and a nice flavour. Season January and February.

The H. L. H.—A cross between the Peach and the Sabre: originated and distributed by Messrs. H. L. Hall and Sons, of Tomango, Transvaal. A first-class fruit; large size, 4 to 5 inches long by $2\frac{3}{4}$ to $3\frac{1}{4}$ inches across. Shape between the first two mentioned, with a distinguishing mark in the shape of a tiny hole near the apex of each fruit; skin delicate apricot-yellow with pink blush, becoming almost red at times; texture tender and fibreless with exquisite flavour; a good bearer. Ripens February and March.

Large Green.—The name exactly describes the fruit. It is the largest mango we have, being 5 to 6 inches long by 3 to 4 inches across; shape flattened, elongated; almost obovate, with slightly curved point; skin medium to dark green, very slightly inclined to yellow when ripe; texture fibreless and tender with very choice flavour. Considered by many to be one of our best mangoes. Fair cropper. Ripens February.

Kidney.—Called by that name evidently on account of its shape. A small mango, 3 to $3\frac{1}{2}$ inches long by 2 to $2\frac{1}{2}$ inches across; skin and flesh yellow; texture moderately free from fibre; flavour good. Season January and February.

The following list has been sent in by Mr. Leon Ducasse as being grown in Natal; the descriptions are his:—

Rosella.—A chance seedling from Mauritius, where it is unknown. Fruit medium size; roundish; very bright red colour; nice eating, probably the most prolific mango grown in Natal.

Fitzpatrick.—Named after the originator, my son-in-law, on whose farm in Natal it appeared as a chance seedling; most likely a cross between Figette and Auguste, as it has the flavour of both. Is a good bearer; colour greenish-yellow when ripe.

The following are the names by which the undermentioned varieties are known in Mauritius :

Charpentier.—Very large flat greenish fruit. Not a heavy bearer.

Auguste.—Roundish shape; medium size; nice flavour. Heavy bearer.

Aristide Labutte.—Medium size: excellent fruit; heavy cropper; colour when ripe yellow.

Maison Rouge.—In Natal, called the Carrot Mango. Colour bright red when ripe; excellent flavour.

Figette.—Very large, bright red on one side, yellow on the other; one of the best of the Mauritius mangoes.

CHAPTER XXI

THE AVOCADO

The avocado is generally termed in South Africa the Avocado Pear. This is not correct as there is nothing of the pear about the avocado excepting the shape, which in the case of the varieties hitherto grown here is a decided pyriform. There are also a number of avocados which are almost round in form and these might be called Avocado Apples with equal justice. In America usually the fruit is called the Alligator Pear, which is quite indefensible and in common with our own incorrect name should be scrapped.

The avocado is a native of Central America (tropical) whence it has spread by slow degrees to such other parts of the world as provided suitable conditions of soil and climate, among which South Africa stands last in order of invasion. It is presumed that introductions of the fruit were made from India and Mauritius to Natal, and that the planting of seeds which followed almost as a matter of course gave rise to the more extended growth of the tree. At present avocados in South Africa are most plentiful in Natal and the eastern portion of the Transvaal. Practically all the trees are seedlings, among them some magnificent specimens are to be found. At Maritzburg, Mr. Seymour English has some of the finest in the country. The avocado is a fairly rapid grower, trees of ten years old attaining a height of 25 feet or over. The leaves are of large size and as a rule are, in our seedlings, inclined to be rather lightish green in colour.

The fruit, which is large and handsome, weighing from $\frac{1}{2}$ to 2 lb. each, may be seen on our markets from February to July, but as the culture of this tree extends, as it undoubtedly will, with introductions of new varieties, it is anticipated that a supply will be maintained all the year round.

At present our avocados are without names to the different varieties grown; they are principally green in colour, but there are also violet, purple and dark reds with a few speckled ones, dark brown spots on a light green ground. All are pear-shaped, thin-skinned, with a large kernel inside which is covered with a thin film of brown skin, sometimes adhering to the fruit, at others to the kernel, which may be of any size from that of a walnut to an egg,

FOUR-YEAR-OLD AVOCADO, IN THE ORCHARD OF H. L. HALL & SONS, TOMANGO, TRANSVAAL.

the flesh or pulp is creamy in colour, and of the consistency of moderately hard butter. It contains a large quantity of vegetable fat, occasionally up to 30%. It is thus under certain circumstances a particularly valuable food.

The fruit is usually prepared by being cut in half, longitudinally, and eaten with a dressing of pepper and salt with vinegar or lemon juice according to taste. The author has heard of the fruit being cut in half at night, each half being filled with old dop brandy, allowed to remain until the morning, when it is supposed to make an excellent " eye-opener " This is, however, merely hearsay. It is also used in salads.

So far little success has attended any attempt to export avocados. The author has seen box after box of the fruit opened in London at Covent Garden Market with rarely more than 5% of sound fruit. It is apparent, therefore, that under present conditions the development of an avocado industry here would have a pretty hopeless outlook. It has long been recognised that no great increase can take place in the growth of any kind of fruit in South Africa which cannot be exported. Our own market is limited by the scantiness of our population and its appalling lack of appreciation of fruit as an article of ordinary diet.

Recently, however, a change has taken place in the culture of the avocado, due principally to the interest displayed by enthusiasts in Florida and California, U.S.A. In the latter State, an association has been formed and some endeavour made to inquire into the various methods most suitable for the growth and cultivation of the trees and to classify races and varieties.

As a result types have been recognised as being suitable for extended cultivation for the purpose of long distance shipment and some of these have been imported into South Africa in the hope that they may prove of use in building up an export business in this fruit.

The principal objects sought for were :—

1. A variety or varieties having carrying capacities sufficient to bear the strain of export from here to Europe.

2. A hardy constitution and good bearing qualities.

3. A succession of varieties to ripen as nearly as possible all the year round.

The carrying qualities, it is anticipated, should be found in the avocados of Guatemalan and West Indian origin which have a rough, hard skin, quite unlike those known as the " Mexican type " strains of which we now grow almost entirely wherever the fruit is produced in South Africa.

It is hoped that an extension of the present season of ripening will be obtained from the same source, while with the development of

the industry the suitability of different types to different districts may be expected to occur.

Varieties recently introduced by the Agricultural Department embrace the following :—

Variety.	*Type.*	*Date of Ripening.*
Sharpless	Guatemalan	November to February
Puebla	Mexican	March to April
Spinks	Guatemalan	,, ,,
Dickinson	,,	December to March
Fuerte	Hybrid. Mex.X.Gatn.	November to February

All the above were introduced in November 1921.

Pollock	West Indian	February and March
Trapp	,, ,,	March to June

Simmons and *Persea drymifolia.* The latter is a Mexican seedling which might be used as a stock. These last four sorts were introduced in January 1923. The above information has been supplied by Mr. C. P. Lounsburg, late Chief, Division of Entomology, Pretoria.

Seeds of the following, supplied to the author by Mr. Paul Popenoe, Altadena, California, in 1921, have been distributed for propagation, the growth has been in most cases entirely satisfactory.

Puebla	Mexican type	
Dickey	Guatemalan	
Taft	,,	
Blakeman	Guatemalan	Ripens February and March
Spinks	,,	,, ,, ,,
Carton	Mexican	,, March and April.

Among the above are some of the most popular kinds in vogue in California and Florida. The Trapp which is a round and not pear-shaped fruit, is one of the most sought after varieties in the United States. Trapp is an excellent shipper and has travelled all over America in good order. It is contended that it is the best commercial variety in that country.

Of these late introductions, it may be interesting to note that Puebla, Spinks, Blakeman and Carton commenced to bear fruit on trees grown from seeds in March and April 1926 and 1927. That borne by Spinks and Puebla has the typical rough skin of those varieties, Spinks is the smaller of the two; both are of good flavour and have every appearance of becoming acceptable additions to the varieties we already have. Blakeman and Carton are

smooth-skinned varieties very like the avocados one usually sees here, but both have a seed much smaller than the common type. All are dark purple, almost black in colour.

With extended plantings in view, it must be borne in mind that the varieties we now have will probably prove more hardy than some of the new-comers. The Mexican type is conceded to be the hardiest, next comes the Guatemalan and lastly the West Indian. The latter should only be planted at very low altitudes. It would appear to be specially suitable for the coastal districts of Natal. The dates of ripening given are approximate.

It will be seen, therefore, that a nucleus has been formed from which quite a different aspect of the avocado industry may and should arise. By the use of seedlings, which owing to their origin may vary from their parents, and by the results of hybridising, selection and the propagation of the fittest, also possibly as a result of future introductions, a stamp of avocado will be found having all the qualities required for the successful conduct of a profitable export business.

The commonest complaint with regard to the present type of avocado grown in South Africa is that they are shy bearers, not yielding good crops annually. Many do not begin to bear until they are ten years old and upwards. Just as a seedling orange or naartje tree is longer in coming into bearing than a budded tree, so it is with the avocado, only in this instance the time is sometimes so prolonged as to cause the unfortunate grower to despair of ever getting any fruit. Fortunately, when the avocado is budded, it becomes one of the earliest of trees to come into bearing. Some specimens from two-year-old buds have a sprinkling of fruit when the little trees attain the age of three years, while a crop when they are four years of age is by no means an unusual occurrence. It must be admitted, however, that all budded avocados do not act in the same way, and sometimes six or more years may pass before anything like a decent crop is harvested. These are exceptional cases.

According to a circular issued by the U.S. Department of Agriculture, the avocado has two sets of flowers, which under normal conditions have definite periods for opening and closing.

In some varieties the first period flowers (receptive) open in the morning, with second period or pollen-shedding flowers opening in the afternoon. In the other varieties the order is reversed, the morning flowers shedding pollen and the after flowers being the receptive ones. Since the receptive flowers are closed in each case, when the pollen-shedding flowers are open, pollination within a variety does not take place except under abnormal weather conditions. However, it is possible, says the Department, to secure cross-pollination by planting varieties of the two groups together.

Little is yet known as to the best varieties to plant together; but solid plantings of a single variety or of varieties all of one class are decidedly unwise in the light of the data presented in the circular.

Firminger, in his "Manual of Gardening" (Calcutta 1904), quotes Sir. J. Paxton as saying that, "It may be struck from cuttings of half-ripened wood and planted, without mutilating the leaves, in sand under glass." This method of propagation is deserving of a trial, though it is not used here at present. Practically all avocados are raised from seeed and the seedlings budded over to the varieties selected. Doubt exists and must continue to exist as to the best type to use as stocks until further work has been done in that direction; probably some of our local strong growing varieties may be eventually chosen. The practice of budding the avocado is now becoming more generally in use in South Africa, but there is still plenty of room for expansion in this direction.

Seeds should be planted either in half paraffin cases or properly prepared seed beds; they should be placed point upwards, the point just showing above the ground; germination takes place very quickly. The soil, which should be a very light sandy loam, must be kept moist but not wet during the germinating period. Shading of the seed beds with canvas or reed screens is advisable during the time when the young plants are in the tender stage, gradually hardening off so that by the time they are 8 to 12 inches high they are fit for transplanting to the nursery for setting out in rows.

One may frequently see an avocado seed growing, suspended over a glass fruit jar with its base just touching the water, with which the jar is nearly filled. The plant grows readily enough in this crude way, showing how simple the process of germination is, it may even be planted out after having been thus grown, if sufficient care is taken.

Budding the avocado has always been regarded as a somewhat difficult process, probably that is the reason why it has been so little practised here. There are, however, quite successful budders of this tree and their proficiency has been attained by very careful observation of a few cardinal points. The most important are the maintenance of the *stock* in a condition of rapid growth, this depends largely on water and cultivation, and the *freshness* of the *buds* used; they should not be of green or sappy wood on the one hand, nor on the other of old wood, but rather of wood half-matured of the season's growth.

The actual operation of budding is much the same as that in use for the budding of ordinary fruit trees, either the ordinary or the inverted T may be used. The bud itself should be larger than those mostly in use—say 1½ inches or more in length, depending on the

size of the stocks, and it is customary to leave a small piece of the wood from the parent tree in the bud. It should be tied in with either waxed cloth or raffia grass, leaving the eye exposed. Tying of the bud to the old stock stub takes place when the new growth is about 4 or 5 inches long. The usual nursery methods of cultivation are then observed until the time comes for transplanting to the orchard. The young trees should be very carefully dug, and replanted at once in paraffin cases in light sandy soil, placed in the shade and sparingly watered until they have become established; when they are ready for shipment, not more than half a dozen trees should be put in one case. If the grower wished to plant out avocados for himself, of course the transplating should be done directly into the permanent places which the trees are to occupy in the orchard. The avocado will thrive on quite light sandy soils, as may be seen at Nelspruit and district (Transvaal); it grows equally well on the red loams so largely used for orange and other citrus trees. Probably as our experience widens we shall find that certain types will prefer heavier soils than others, a good deal will depend on the class of stock used. It is, however, far too early to lay down any rule in that direction.

In most of our plantings, trees are set out at from 25 to 30 feet apart. The growth of a seedling avocado is very vigorous and trees of 50 feet high are not unknown. The use of budded trees will not necessitate a greater distance than 30 feet, and frequently 25 feet will be found sufficient. Cultivation of the orchard is similar to that in use in citrus orchards and irrigation should be carried on in the same way. In Firminger's book, to which reference has already been made, it is stated that "Humboldt met with enormous trees near Caracas, where they water them either with fresh or salt water." The author has no knowledge of the effect of brack water on the avocado; it is possible that it might be used with little injurious effect. The quantity to be used depends to a large extent on the class of soil under cultivation, but it is generally accepted that for the best results a good soaking of the ground about blossoming time with moderate irrigation at intervals of a month should be given, during the drier period of the year.

Mulching the trees with litter of some kind, grass, straw or weeds or anything of a similar nature, is practised in Florida; the same might be tried in South Africa. The purpose served is a dual one, as not only is the soil prevented from drying out rapidly, but the tender and sensitive young feeding roots are protected from any possible injury from excessive heating of the soil. The mulch should be spread round young non-bearing trees for a couple of feet about the stem and in the case of older fruiting trees as far as or a little further than the spread of the branches. Where white

ants are present this mulching is hardly advisable unless special care is taken to guard against their ravages.

Little is known with regard to the actual needs of the avocado in the matter of fertilisers. Cultivation of the fruit commercially is comparatively of very recent date and we in South Africa have had no opportunity to experiment even on what may be most suitable for use. Even in those States in America where the growth of avocados has been carried on for some few years, nothing has been definitely arrived at in the way of what may be called a generally sound fertiliser to use. Taking into consideration the very large yields which are occasionally found here on trees which have scarcely any fertiliser at all, it might be assumed that its application is not a matter of urgency. This, however, would be a sad error to fall into and growers are advised to make a study for themselves as the results obtained from such fertilisers as, in the first place, ordinary kraal or stable manure which may be regarded as safe to use in good quantities, and also in combination with nitrate of soda, dried blood, and cotton-seed meal as suppliers of nitrogen, burnt kraal ash and sulphate of potash as suppliers of potash and bone meal and superphosphates as yielders of phosphoric acid.

Local markets are well supplied with the fruit wherever the railway extends; packages are the usual wooden boxes in general use for the export of most classes of fruit and prices realised are as a rule satisfactory. Avocados are to be bought on most of our markets at from 3*d.* to 9*d.* each. It may be stated that these figures are far lower than those generally asked and cheerfully paid in America. Packing in a very little wood wool is the rule and the fruit carries quite well when handled in this way. Some growers prefer to pack without anything besides the paper in which each fruit is wrapped.

The outlook for rapid expansion of the acreage under avocados is not too encouraging at present; budded trees, which alone are worth planting, are only to be had from two or three nurseries. The extended raising of them by the general nursery trade is precluded by the fact that a frostless situation is needed for their production and most of our larger nurseries are not situated in such areas. The most promising districts for future development of the avocado business are to be found in Natal and the low veld of the Transvaal from Barberton almost to our northern border. Suitable conditions might also be found in the Eastern Province of the Cape and possibly South West Africa.

CHAPTER XXII

THE LITCHI

The litchi is a native of China, where it has been grown from time immemorial. Popenoe quotes MacGowan, writing in "The Agri-Horticultural Society of India," 1884, p. 195, as follows :—

> "Litchis were first sent as tribute to the Emperor Kao Tsu about 200 B.C. These were dried fruits, however. Later fresh ones were forwarded by relays of men and one is happy to learn that though the cost of human life was frightful, they reached the Emperor in good condition."

The word litchi is differently pronounced, as follows :—*leechee*, *liechee* and *liechie*: probably the name or manner of pronouncing it differs with the district from which it comes and each may, therefore, be equally correct. Generally speaking, in South Africa it is pronounced *leechee* though *liechie* has its supporters. The introduction of the fruit into Natal is of comparatively recent date.

Mr. Leon Ducasse, who has introduced so many fruits of a tropical nature into South Africa, writes :—

> "When I arrived in this country in 1875, there was at Redcliffe, at Mr. Milner's estate near Verulam, one litchi tree about six years old and one in the botanical garden at Durban about the same age. It is there now. In 1876 I brought in several from the Mauritius. I have never heard of other trees being in the country at that time."

It is safe to say that Mr. Ducasse was the first to distribute young trees. He adds :—

> "There are supposedly several kinds of litchis in Natal imported from India—I can see NO difference in the trees or the fruit. There is, however, a variety known in Mauritius as 'Longan' which is also to be found in Natal. The fruit is smaller, of a brownish-green colour when ripe, with a large stone and very little flesh on it. It is a very fine tree, quick growing, very vigorous and the only tree on which litchis can be grafted. It is not a patch on the litchi as a fruit. The litchi, like most fruit in Natal, is gathered weeks before it

is ripe and has not then the true litchi flavour. It is like eating a green Hanepot grape. The shell of the litchi would be of a brownish-red outside and of deep crimson colour inside; until the shell has taken that colour the fruit is not ripe and has not the proper flavour; few people in Natal know that flavour for the very simple reason that the fruit is offered for sale when it is not really ready to pick."

Note.—As far as the author is aware, the Longan is to be found in South Africa only in Natal.

PROPAGATING THE LITCHI BY MEANS OF "GOOTEE."

Note the tins containing water and the strings attached to each, by means of which water trickles down to the "Gootee." Orchard of H. L. Hall & Sons, Tomango, Transvaal.

The litchi has found things quite to its liking there as far as soil and climate are concerned and has become thoroughly acclimatised along the coast and is also to be found inland in the low veld of the Transvaal, and there is little doubt but that it would be equally at home in other of the warmer sections of the Union, provided precautions were taken to protect the trees from cold when they are young.

The tree is a handsome one and grows to be from 20 feet high upwards; it is difficult to say what height it might attain as its introduction to the country is so recent. At Durban and Verulam and other parts of Natal and Tomango in the Transvaal, many fine trees are to be seen. The natural tendency is a spreading one, and

as a consequence, plenty of room—not less than 30 feet—should be allowed when planting them in orchard form.

The leaves are lightish green in colour, long and glossy—in fact the tree is one of the handsomest we have and would make an acceptable addition to any garden or park where conditions are suitable. The wood is very brittle and branches are liable to succumb to high winds. The fruit is unique; the author first made its acquaintance in San Francisco—to which city it is still imported in considerable quantities. Litchis were sold there under the name of "Chinese nuts." As a fact when the fruit is dried, as it is when exported, it looks more like a nut than anything else—if one can imagine a roundish slightly pointed strawberry, dark brown in colour with a thin, fairly hard, yet brittle shell with an opaque, whitish, tough, half-dry jelly within, containing a seed dark brown in colour, a fairly correct idea of a dried litchi is acquired.

The flavour of these dried nuts is sub-acid, attractive and indescribable. It is, however, in its ripe state that the flavour of the litchi is at its best; there is no other flavour quite like it and the fruit has to be eaten thus in order to appreciate its subtle attractiveness. Small wonder that the Chinese poet, Su Tung Po, whilst living in Canton, declared litchis would reconcile one to eternal banishment. Yet he did not allow his enthusiasm to draw him into gastronomic indiscretions, for he limited himself to a modest 300 a day, whilst other men (so he says) did not stop short of 1000 (Popenoe, p. 312).

The fruit is borne in clusters, each of which may have from 5 to 20 fruits, but an average would be probably less than a dozen. When ripe, the shell has a reddish-brown look, but as it gets dry it becomes quite brown. The flesh is jelly-like, whilst it takes quite a lot of biting to get the flavour and juice out of it. The seed, which is dark brown in colour, is small, about $\frac{3}{8}$ inch long by $\frac{1}{8}$ inch across.

The tree is one of the longest lived of all fruit trees. Dr. Bonavia, who has written extensively on Indian fruits, says:—

> "An orchard of litchis of a few hundred trees would give a handsome and a most certain annual return for not improbably one hundred years."

Chinese authorities state that the tree lives to be 800 years old.

The litchi appears to do well in South Africa on a deep, light, sandy loam and also on the heavier red loams. Depth seems to be the essential and that is easily understood when one stops to think of the great age to which the tree lives. Experience in other countries has shown that it requires lots of moisture at the roots and that it does well in soils where we should not think of planting a

fruit tree. Black turf and land of a similar class are mentioned as suitable, provided there is moisture in plenty. Litchi trees alongside a water furrow are also reported to be doing well. In any case, the question of sufficient irrigation water is important: the litchi requires as much as the orange. Further, if one may judge by the methods of using water for the litchi in India, it is quite in order to make a basin round the tree and run water into it. The tree is evidently unharmed by too much water near the stem—40 to 50 inches per annum are not too much.

Climate and Altitude.—Whilst the tree in its infancy will not stand low temperatures and is killed outright by one of 32° Fahr., when it attains age it is able to put up with some few degrees of frost without serious injury. Still, the best trees we have in South Africa are growing in frostless situations; these embrace the whole of the coast line and the low veld of the Transvaal. An altitude of 2500 feet at Tzaneen is proving quite suitable, and is perhaps the highest at which the tree is planted at present. The situations in which the tree flourishes in Natal are considerably lower than that; for instance, Verulam is under 200 feet. The humid atmosphere found along the coast together with the usual good rainfall seem to agree with the tree remarkably well.

Planting and Cultivation.—As previously stated plenty of room should be allowed for the litchi tree to develop. A distance of 30 feet is by no means too much. Trees of about ten years of age in the Transvaal, planted at 25 feet apart, now almost touch. The usual sized hole appears to be entirely suitable for the tree, though very large ones, in which rotted manure and leaf mould, with extra good soil thrown in, are sometimes recommended.

Cultivation such as is given to the mango and avocado suits the litchi, but from Chinese records it would seem that growers there give lots of manure of a nitrogenous nature. Little is known so far in South Africa about the fertilisers needed by the litchi. With the advance of time and the experience gained, it is only reasonable to suppose that correct methods of fertilising will be decided on and adopted.

Propagation.—Seeds of the litchi are no more likely to reproduce truly their parental characteristics than are those of any other fruit. The varieties are numerous, but in South Africa unnamed. They are simply "litchis." No effort has been made at any Government Experimental Station to give information on this point; indeed, the absence of a suitable tropical station has rendered such work impossible. Popenoe states that there are thirty or forty kinds known in the vicinity of Canton. Later, we might possibly obtain other and named varieties, meantime we must carry on with those we have.

The young trees grow readily from seed and these are worked either by layering or inarching as described for the mango. Layering is resorted to in India, but the gardener there is an expert in inarching and probably the largest number are produced in that way. A seedling tree may take up to ten years before it bears fruit, though lesser periods have been mentioned. A tree grown by inarching will bear fruit in three or four years—and one grown from a layer in less.

In India, " Gootee " or " Goti " is largely in evidence as a means of propagation. It is thus described by Mr. Masters, late of the Calcutta Botanical Gardens.

> " Select a firm, healthy branch, the wood of which is well ripened, and immediately under a leaf bud take off a small ring of bark about an inch wide, scrape the woody part well so that no bark remains. Apply a ball of well-tempered clay: bind it on securely with a tow or other soft bandage. Make it fast to a stake if necessary, hang a small pot having a hole in the bottom just over the gootee and supply it with water daily. In a few months you obtain a fine rooted plant. As the fibres are emitted from the buds which are above the wound, they descend into the ball of the earth and form roots. As soon as they are seen protruding themselves through the bandage, the branch may be cut off from the parent tree (the cutting should be done progressively) and planted where it is intended to remain. This appears to be the most expeditious method of obtaining strong well-rooted roots, and at the same time is a sure method of procuring duplicates of any desirable variety. Of 65 gootees made in June of the *Jonesia ascosa*, the whole were well rooted in October, while of 45 layers made at the same time and on the same individual tree, none were well rooted and some only just beginning to form. The leechee requires four months to form good roots."

Little or no pruning is done on the litchi. So far the supply on the market is very limited. The total number of trees in South Africa is also extremely small, probably not over 2000. When the fruit does appear it is put in the ordinary orthodox tray of $18 \times 12 \times 2\frac{1}{2}$ inches which sells for 3*s*. to 4*s*. It only wants a supply for the demand to increase to an enormous extent.

CHAPTER XXIII

THE OLIVE

"And they said unto the olive tree, Reign thou over us."—Judges, ix, 8.

Wild olive trees are found growing all over South Africa. They are indigenous to this continent, and cultivated varieties have been known and grown in its northern portion from time immemorial. There is little doubt but that the tree in its wild state can be found from the Cape to Tangier.

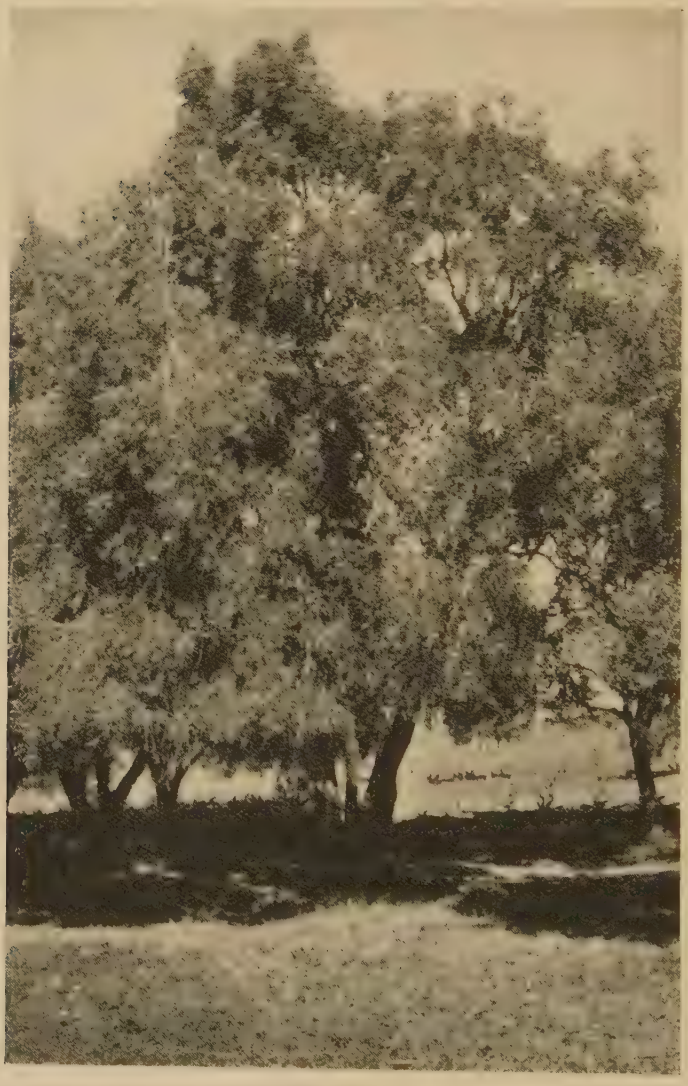
Writers dealing with the subject of the olive have said that the tree is a native of Asia Minor; it is equally certain that it is indigenous to Africa also.

No date can be mentioned when the olive was not grown in the northern portion of this continent. It is one of the first fruits to be mentioned in the Bible: "the dove which came back to the ark bearing an olive branch." The tree was held in high esteem by the Greeks, by whom it was dedicated to Minerva, and by the Romans it was used in the laurel crowns of their heroes when awarded a "Triumph."

Not only was the fruit made use of as a producer of oils as an article of food, but it was generally accepted that the oil itself was of the utmost benefit when used externally on the human body. Massage as an art was fully understood. The old Roman saying, "Oil without and wine within," conveys the idea that the use of both was regarded as conducive to a perfect state of physical happiness, and if with both these desiderata present a man was not happy, he ought to be.

The principal olive-producing countries formerly were Greece, Palestine and parts of Asia Minor. The Mount of Olives—sacred ground to the Christian—had an oil press. To-day the culture of the fruit is chiefly conducted in European centres, in France, Spain and Italy. The olive is grown in Australia and is also largely cultivated in California, where the tree is an exotic and not an indigenous one.

The olive has had many vicissitudes in South Africa. The tree grows well and has been successfully cultivated at the Cape. There is a small olive orchard on the slopes of Table Mountain. Interest in its culture has been of an intermittent nature. A wave of



OLD OLIVE TREE IN ORCHARD OF MR. MINAAR, PAARL, CAPE PROVINCE.

enthusiasm carries the olive on its crest for a year or two and then recedes and leaves it high and dry. Considerable interest has been manifested in the Eastern Province of the Cape and at Amanzi, where Sir Percy Fitzpatrick is displaying much zeal and energy in the study and cultivation of the olive.

The only successful orchards of which the author has knowledge are situated near Paarl, Cape Province, and belong to Mr. Minaar and Mr. R. D. Koch. About 1904 some Italians with a knowledge of olive culture saw the trees and realising that the development of an industry was possible, have done a certain amount of work there, producing an oil of excellent quality. Very fine olive trees were grown and a few still remain at the old Experimental Station of the Agricultural Department at Warm Baths, Transvaal. Some eighteen varieties were planted there about 1905 and the growth of the trees was excellent, equally as good as anything either in Europe or America.

Unfortunately, the one particular pest which affects the olive most injuriously was also present in the shape of the " Olive Fly," a tiny insect which is most difficult to destroy. Spraying and fumigation were resorted to at the orchard at Warm Baths, and by the adoption of these methods it was found possible to produce fair to good crops of olives. Whilst this particular fly is found at the Cape, it has not had such a bad effect there as it has further north. It is possible to grow olives at the Cape without constant resort to the use of insecticides, and when the anticipated development of the olive industry occurs it will probably take place in that Province. The author has distributed seeds, cuttings and truncheons to various firms and individuals from Uitenhage to Kimberley.

Altitudes and Districts for the Olive.—It was once a largely held belief in Europe that the olive tree would not flourish at a greater distance than 90 miles from the sea. It was supposed, like the apricot, to have a weakness for sea breezes. In South Africa the tree flourishes and bears fruit at only a very slight distance above sea level at Cape Town, and also at Warm Baths in the Transvaal, at an altitude of 4000 feet. It does not follow that it will succeed at any point between the altitudes mentioned. Extreme heat or cold are both alike detrimental to the growth of the tree and the production of fruit. It is supposed to be most at home with a mean temperature varying around 60° Fahr. At the Warm Baths Experimental Station it has experienced 12° of frost without injury and it is stated that the tree may be exposed to 18° and suffer no harm.

So few trees are planted in South Africa that local data are hard to obtain. Up to the present time, the best results are, as mentioned already, from the district of Paarl. There the trees stand almost at the foot of the mountain, have no frost nor any extreme variations

of temperature, but are subject to south-east winds during the summer. The distance from the sea is about 30 miles. The situations to be avoided are apparently those which are subjected to sudden fluctuations of temperature such as may be experienced when trees are exposed to the hot afternoon sun after being in the shade up to mid-day, thus the exposure found to be best suited to the requirements of most of our fruit trees, *i.e.*, north-east, is equally well adapted to the olive.

Soils for the Olive.—Taking the growth of the tree in its wild state as evidence as to the class of soil which it likes best it is apparent that the finest trees grow where a certain amount of moisture is obtainable; on the other hand, many trees of fair proportions are to be found in the sandy soils of the Western Province and others of a very poor nature. The Transvaal soil in which many cultivated varieties of the fruit succeeded admirably is a slightly sandy red loam such as is common there is the bush veld, 20 feet deep and underlaid with gravel. The lack of lime is noticeable, and the same weak point is present in the Paarl mountain soil. From Spanish and Californian records, it seems that lime is one of the chief constituents demanded, and that when it is present in the soil together with a good amount of potash the needs of the trees are pretty well served. As reliable local experience is so extremely limited it seems that we cannot do better than take the behaviour of the tree in its natural state and get what guidance we can from that quarter.

That would seem to indicate that olives can be grown with success in the Cape Province in the western, north-western and eastern portions, in Natal and the bush veld of the Transvaal. Cold soils and situations are unsuitable, thus the high veld of the Transvaal and Orange Free State is not likely at any time to become an olive-producing district. The olive has less objection to brack soils than most other fruit-bearing trees and there are instances of very fine specimens of this tree being found on soils which are certainly of a brackish nature.

The olive is grown at the present time for two distinct purposes, *i.e.*, the production of oil and pickles. It is necessary therefore to examine the different requirements so as best to produce what is wanted in each case.

Thirty years ago, when the author left California for South Africa, all the largest and best olives were kept for the oil press, as only the best of the crop was wanted for the making of oil. Now, all the largest and finest specimens are set aside for pickles and the small fruit and culls are used for the making of olive oil.

Although the tree will grow in very many localities, it is easily apparent that those planted in the best soil will yield the largest

fruits and so we may eventually find deep, rich, alluvial soils planted to olives the fruit of which will be devoted to the pickling business, whilst the light soils found so often on the hill slopes will be used for the planting of olives which will go to the oil press. That also means that certain varieties will be set aside and recognised as being suitable either for one or the other purpose.

Pure olive oil is difficult to obtain nowadays. There are so many vegetable oils of similar appearance generally, such as cotton-seed, monkey-nut and sunflower oils, that adulteration has been carried on to an alarming extent; in fact, some one or other of the latter named oils may (after delicate manipulation) be passed off to the ordinary purchaser as olive oil. The appearance is almost identical.

Provided then that the climate is suitable, there is a wide selection of soils in which the olive will grow. Whilst able to draw its sustenance from a rocky hillside, it responds to good soil and treatment like most other trees and because it will put up with poor soils there is no reason why it should be made to do so, unless specially decided as being, for instance, one way of making what might otherwise be a waste plot of ground into a profitable one.

Propagation.—The olive is propagated by means of seeds, cuttings, tip cuttings and truncheons principally, also by planting of suckers, layering and the planting of root cuttings.

Of the various methods, the three last mentioned are not often made use of and are scarcely worth discussing at length. The planting of suckers induces the formation of an annual crop of suckers which merely rob the tree of its strength. Layering produces a tree with a one-sided, mutilated root to start life with. The rooted cutting after being grown has to be grafted or budded and is neither as desirable nor does it make as good a tree as the ordinary seedling.

Nature's way of reproduction is the best to follow, *i.e.*, by seeds, and the resulting tree must be budded or grafted in order to secure the desired variety. The most vigorous young trees are those grown from the seeds of the wild tree; their progeny is hardier and quicker growing than that of any cultivated variety. The author has at different times distributed many parcels of seeds of the wild olive over a large portion of South Africa. Seed from ordinary cultivated varieties may also be planted, but are not considered as suitable as those kinds nearer the wild state. Some few years ago it was determined to introduce into South Africa varieties of seed which were considered in California to be specially suitable for stocks and this was done. The "Redding" variety which bears a small fruit, but is one of the strongest growing trees, was considered the most likely to prove of use as a producer of hardy, quick-growing stocks.

Although the best olive trees are without doubt produced by

growing from seeds, the actual raising of the stocks from the seed is by no means easy. Seeds planted just as they are taken from the fruit stand a very poor chance of germinating, and as a rule only 1 to 2% will grow during the first season, and hardly ever more than 20% in the second. It has been found both in Italy and California that, if the seeds are carefully cracked, without injury to the germ and the kernels extracted, germination takes place in a very satisfactory manner. For the purpose of opening the seeds a little device has been introduced at one of the Californian Experimental Stations which clips the ends, and by this means the preparation of seeds for planting is rendered easy and quick.

It was considered in Italy that if olives were fed to goats and the seeds planted afterwards, such seeds germinated far more readily and in greater numbers than when treated in any other way. It is necessary in all cases to free the seeds from the fleshy part of the fruit before treating the pits. This is done by placing the ripe fruit in heaps to rot and washing the pits afterwards. It is of the utmost importance that all the fruit should be quite ripe before being handled in this way as it is known that seed contained in unripe fruit is not likely to germinate quickly, if at all.

If the seed is cracked, the kernels should be planted about September; if the ends only have been clipped, the same time for planting is suitable. Cracked or clipped seed should germinate within a few weeks.

They should be planted in a light, rich soil, at about 2 inches deep. If only a few are to be dealt with, they may be sown in the ordinary "flat" or half paraffin tin. If any number, they should be set out in the usual style in nursery seed-beds, care being taken as to the exposure to cold or any extreme conditions of climate. When 8 or 10 inches high, and perhaps getting on for a year old, they should be transplanted to ordinary nursery rows and at this time both roots and branches should be trimmed, the roots, especially the tap-rot, being brought within reasonable bounds (cut just where it becomes small) whilst all the lateral branches should be removed. If this is done at this stage, the cuts heal over quickly. If left, a scar remains.

Propagation by cuttings was and is still popular, on account of the ease with which it may be done. The resulting tree may not be as long lived as one grown from seed, but to the propagator this is not at all times the first consideration. Ordinary cuttings should be taken during July or August; they should be from 12 to 15 inches long and from $\frac{1}{2}$ to 1 inch thick. The bottom end may be split transversely to induce rooting. They should be planted as soon as possible after cutting, in a sheltered situation, in rows about a foot apart in the row, only the topmost bud should be left exposed. The

ground should be kept moist—not wet. With the advent of warmer weather, the cuttings should be irrigated occasionally until growth starts, afterwards they may be transplanted to their permanent site when 3 feet high.

Tip cuttings are made by taking the end of the young branches and cutting them into lengths of about 4 or 5 inches. Each branch may be made to supply four or five cuttings before the wood gets to be too thick for this method of propagation. All leaves should be removed with the exception of the two at the top of the cutting and these may be cut in half—straight across. The tips are then planted in tins or shallow boxes and placed in a frame or some kind of glass or lath-house. Careful watering must be maintained, though not to an excessive degree. As soon as the young growths are a few inches high, the cuttings must be transplanted and cared for in a nursery until they are fit to plant out, *i.e.*, when about 3 feet or more high.

Propagation by means of truncheons is a method not much in vogue at present. In 1903 the Transvaal Agricultural Department was presented with some truncheons by the Government of Cyprus. They were carefully looked after at Skinners Court, near Pretoria, but although they grew satisfactorily in a few instances, the variety was not worth propagating and the trees were abandoned. It was shown conclusively that truncheons can be sent for long distances without impairing their vitality and this appears to be the chief merit in this means of propagation. A truncheon may be three to five inches in diameter and of any length desired. Common practice is to saw them half-way through at spaces of 6 inches or so apart, then plant or " bury " the whole truncheon horizontally in a warm, moist situation. Young shoots occur near the cuts and these are removed with their adherent roots and planted in nursery rows for further transplanting at the right period.

Truncheons may also be planted in the vertical position, but this is not frequently done, although still followed in some parts of Spain. In Italy, however, as far back as 1882, the Congress of Italian Agriculture recommended that all olives be raised from seed, in preference to any other method.

Propagation by means of rooted cuttings, similar to the method of propagating blight-proof apple stocks, is also sometimes adopted. No olive tree, however, equals those produced from seed.

Budding and Grafting.—The olive may be budded just the same as any other fruit tree. It is well to observe the utmost care in the operation and to make the buds larger and longer than is usual in the case of, say, peaches or plums. It should be done for preference in the spring when the sap is in full flow. Waxed cloth (calico) is used to wrap the buds instead of raffia.

Budding by means of the " twig " method is also successful, instead of just single buds, a small twig is cut from the tree to be propagated; it also is cut large and deep and the bit of wood left inside the bark in cutting is removed. As a rule, little difficulty is experienced in getting a good " take " by this method; after insertion of the bud, the ordinary practices are followed. Twigs for budding are about 2 or 3 inches long, and the leaves are removed or cut in half when the bud is inserted.

Grafting is rarely used to propagate young trees. On the European Continent it is held to be unwise to graft any kind of olive tree for any purpose until it is six years old or over. For the working over of old trees, however, grafting is frequently resorted to. The cleft graft described in the chapter on grafting is quite useful and the bark graft does equally well.

Distance for Planting, etc.—The author's first recollections of an olive orchard are centred round " El Quito Rancho " or the Quito Ranch near Santa Clara, California, one of the most celebrated of all the many fine olive orchards in that State. The trees there had been originally planted less than 20 feet apart, and every other one had to be taken out. In 1889, they were still too close together. This shows quite clearly that the olive tree requires plenty of room in which to develop.

The olive is not a tree which needs to be kept to within small dimensions. The larger the tree and the more spreading its branches the heavier the yield of fruit. It is thus wise to be generous in the matter of space when setting out an olive orchard, and this is more particularly the case when land is the price at which it can be bought in South Africa.

Probably 30 feet apart is about the best distance and as the trees will not require to use all this room immediately, it will be seen that, providing the square system of planting is adopted, there is plenty of room for a fifth tree in the centre of each square. Early-bearing varieties of peaches or plums might be planted with advantage.

Either winter or summer planting may be adopted. If the former, then July is the best month. If summer planting is decided on, either November, December or January may be selected as rainfall or its absence may suggest. Summer planting is most desirable in the Transvaal owing to the fact that the rainfall is due then. Similar conditions prevail in the Eastern Province of the Cape and Natal. The only portions of the country where winter planting would be preferable are the south-west and western portions of the Cape. It is unlikely that irrigation would be necessary to any extent after the initial watering at planting, but should no rain fall for twenty days, a watering should be given.

European custom has decided that the olive requires a large hole to be made for it when planted in orchard form. They advocate the digging of a pit 3 feet wide and 3 feet deep. For planting under ordinary circumstances, the sized hole commonly in use in South Africa, *i.e.*, 2 feet wide and 2 feet deep, should fill all requirements. Planting on hill slopes in longitudinal trenches lying along the slope may be done in trenches 18 inches wide and a couple of feet deep. This method is unusual, but it is claimed that by reason of the roots having a soil which has been at least half " trenched " the roots extend more rapidly and the growth of the tree is proportionately accelerated.

Pruning.—The bearing of regular crops is retarded unless the tree is properly cultivated, manured and pruned, also, in some instances, irrigated. Pruning the olive, according to Mr. Marvin, who was for some time on the Quito Olive Farm, should take place only every other year. In his work on the olive, San Francisco, 1889, he says, *inter alia*:—

> " The olive should be pruned every two years, but the process will have to be varied with the species cultivated. Some varieties need the knife, others require it but little. Still it is necessary to prune the olive, but skill, knowledge and attention to the wants of the tree are needful to secure the best results. Some of the old world sayings embody this truth and in a few words give us the experience of centuries:—
>
> " ' He who ploughs, hopes; he who manures, begs; but he who prunes the olive, obliges it to produce.'
>
> " ' For the olive and the oak, the spade below, and the hatchet above.'
>
> " ' Strip me and I will bless you, make me poor and I will make you rich.'
>
> " No one would think of adopting these maxims literally in their treatment of the tree, but their tendency is evident.
>
> " It is necessary to avoid pruning too long, which would carry the sap to the extremity of the branch to the detriment and destruction of the centre. On the other hand, too short pruning would force the sap into a number of buds that would be found on the young branch and flowing back to the old would result in false wood, that is, branches out of place and contrary to nature. If one side of a tree grows with too much vigour the strong branches should be pruned short, but the feeble ones left long in order to encourage the sap to flow into them, and, on the other hand, the reverse should be done with the feeble side, the weaker branches should be cut off, leaving only enough for appearance' sake, and the stronger ones pruned

long. The first six branches left on a young tree become the principal or primary branches of the tree, from these grow others called secondary, which in turn produce those of the third order. From these spring a multitude of small branches and twigs of one, two or three years of age. Those of two and three years are the fruit branches, those of one year will bear the following season."

"Wickson" in his "Californian Fruits" quotes Professor Bioletti, another old friend of the author, as follows:—

"At the end of the first growing season, no pruning is necessary except the removal of strong shoots on the lower half of the stem where main branches are not desirable. At the end of the second growing season, many trees will require no pruning at all, some, however, will have developed strong branches in unsuitable places. These should be removed. Branches which cross from one side to another, branches which are too crowded or interfere with the symmetry of the tree, or may interfere with cultivation are misplaced. If there is a single strong central branch it should be cut off at its base to promote the open vase form of the main scaffold of the tree. With the upright growing varieties, the problem is relatively simple; with spreading varieties it is difficult. In any case, it is best to drive a strong stake near the trunk and by means of a rope to tie up the spreading branches in the position it is desired to have them in the matured tree.

"This method should be continued, until the trunk, main divisions and branches are well established and the tree large enough to bear a good crop without injury. This condition may arrive by the end of the third growing season, or may be deferred to the fourth, fifth, or later, according to the variety, soil, water, climate and system of pruning. The formative period is then practically over and pruning adapted to bearing trees should be adopted. In a general way the idea is to open the tree and preserve the vase form, so that the conditions for fruit production may be favourable over as large an area of the tree as possible. To do this, it is necessary to cut out branches and twigs, wherever the tree appears too dense to allow free penetration of the sun's rays. Each branch removed should be cut off at its origin, or at a point where a side branch occurs which it is desirable to leave. This applies to small branches and twigs also.

"Cutting back or shortening in should be used with moderation. It has a tendency to produce a dense centre and the growth of vigorous upright sterile shoots and gradually a high

headed tree. It should be used only where necessary to stimulate growth of a weak tree by removing fruiting wood or to prevent horizontal branches from becoming too low."

South African experience is extremely limited in the matter of pruning the olive. It may be taken for granted that the tree will, wherever it is planted in anything like decent soil, make a vigorous growth and this is possible at the expense of fruit production in the olive as in other trees which bear fruit.

Experience in the Transvaal at the Warm Baths Experimental Station went to show that out of the different varieties planted only a few possessed the habit of bearing regular crops. Pruning was confined to keeping the trees within bounds, to a symmetrical shape and to prevent them getting so high as to come in contact with the telephone wires stretched above them.

The hollow goblet shape was adopted as being best suited to the productive growth of the tree and also in order to admit of the easy entry of spraying materials. There is no doubt but that as the culture of the olive advances in South Africa the most satisfactory method of pruning and the most suitable for our needs will be decided on. In all probability the goblet-shaped tree with a hollow centre will become favourite and pruning to achieve this end is simple.

Left to itself, the olive will, nine times out of ten, grow into quite another shape to the so-called goblet. Often it assumes a pyramidal shape. No matter which is finally adopted, the tree must not be so severely pruned as to give it a stunted appearance, neither must it be allowed to put on an inordinate amount of wood. The proper time for pruning is after the fruit is off, and if the two salient points —that the tree bears only on two years' old wood and that the lateral branches are the bearers—are borne in mind, it will hardly be possible for the pruner to go very far wrong.

Naturally, having in mind the purpose for which the fruit is destined will have much to do with the pruning adopted. Olives for pickling are wanted of the largest size possible, so not only is a large variety selected for planting, but the treatment of the tree all round must be studied, so as to produce the required article. The larger and better the olives, the higher the price obtained. For the production of oil, other conditions prevail. Small varieties are sometimes richer in oil than the larger ones and these are selected for the purpose and submitted to treatment in accordance with their needs.

Cultivation, Fertilisation, Irrigation.—The best olive orchards are cultivated very much in the same way as any other well-conducted orchard in a semi-tropical climate should be. As a rule, the land

should be ploughed once annually and cultivation maintained during the remainder of the year. This should be what is termed " clean cultivation," and embraces the planting of cover crops as nitrogen and humus producers.

Virgil in the " Georgics " has a good deal to say about the olive which really amounts to advising his readers that the olive in his days was a very wonderful tree, as the following lines will show:—

" Quite opposite to these are olives found;
No Dressing they require and dread no wound;
No rakes nor harrows need, but fixed below.
Rejoice in open air and unconcern'dly grow.
The soil itself due nourishment supplies,
Content with small endeavours, till they spring,
Soft peace they figure and sweet plenty bring.
Men olives plant, and hymns to Pallas sing.

Present day ideas differ materially from those expressed above and it is certain that whether the fruit is grown either for the production of oil or pickles, both the yield and the constitution of the trees are greatly assisted by the application of fertilisers.

Lime and potash, especially the latter, are the particular soil constituents upon which the tree makes a drain. It is of the utmost importance that the constitution of the tree should not be allowed to suffer through lack of sustenance. The application of the above, giving the lime in the form of basic slag and thus adding phosphoric acid, and potash in form of muriate, is the best way of supplying the needs of the tree. It is customary in Spain and Italy to manure also with refuse from the crushing of the olives, grass, stubble, etc. The olive is the one tree which does not need much phosphoric acid and therefore thrives in its wild state to such an extent in South Africa.

As olives for pickling are wanted in large sizes, the practice of irrigating has become generally more in vogue. Whilst olives have been grown successfully in California with a rainfall of under 20 inches, it is not right to expect large crops of fine fruit unless every possible assistance is rendered to the tree to enable it to produce them. For that reason it has become customary to give two or sometimes three irrigations during the growing season; the first when the trees are about to blossom and the last just previous to the ripening of the fruit. The best paying olive orchards in California are those which are irrigated.

Harvesting the Crop.—Olives for pickling must be gathered by hand, whether for making either green or ripe pickles.

If for green, then as soon as the fruit has attained full size and before any signs of ripeness are apparent.

If for ripe pickles, the fruit must all be ripe, with colour fully developed; the " Arton " pickling bucket is an excellent receptacle into which to pick olives.

Should the fruit be needed for oil extraction, then it usually happens that after the finest samples have been selected for pickling, the small fruit is sent to the oil press. Varieties grown on account of the oil they contain do not need and certainly do not receive such good treatment. The branches are shaken and sometimes the fruit is raked off with a rake made for the purpose and having wooden teeth. In any case, the olive business has entirely changed during the last twenty-five years. The pickled olive has come to stay whilst the oil olive has all it can do to hold its own against so many competitors, each declaring their oil contents to be of as high a quality as the olive.

It is not proposed to discuss here the methods employed either in the pickling of the fruit or the extraction of oil; it can, however, be easily understood that every effort should be made to deliver the fruit to either the oil press or the factory in the cleanest manner possible.

The varieties (16) grown at Warm Baths included:—

Sevillano.—One of the largest olives from which the "Queen" olives of Spain are produced. It is the best olive for pickling but did not prove a particularly good bearer.

Cucco.—This is also a large-sized fruit which was made into excellent pickle by Mr. C. A. Simmonds, in whose charge the trees were. It was the heaviest or one of the heaviest bearers and less troubled by the olive fly than most other varieties.

Ascalano.—One of the largest olives grown. Trees very fine and fruit of the best; a fair bearer but not as good as Oblitza and Cucco.

Manzanillo.—This variety was also rather a shy bearer. It is possible that the lack of bearing qualities in this and some of the other sorts was due to the presence of the olive fly.

Nevadillo Blanco.—Is as a rule planted as an old-yielding variety and ripening about the same time as the Mission.

Mission.—The original olive variety taken to California by the Spanish priests and planted by them at all their Mission stations. Hence the name Mission.

Oblitza.—This was the most successful of all the varieties planted at Warm Baths. A regular bearer, of large fruit, most suitable for pickling purposes, but also used for oil.

Redding.—Seed of this variety was brought over from California in order to see whether its use as a stock would to any extent modify the attacks of the fruit fly. Germination was most successful, but it is now too soon to say what effect, if any, its use has had on the ravages of the fly.

Verrucosa.—This is one of the South African types of wild olives which grows wild throughout the Cape and other warmer parts of the country. It is likely to prove useful as a stock.

CHAPTER XXIV

THE GRAPE

It is said that when the Huguenots came to the Cape in 1687 they arrived with the Bible in one hand and a vine in the other. Be that as it may, the early development of the grape and wine industries must be credited to the Huguenots rather than to the Dutch settlers, although Van Riebeek certainly introduced many thousands of vines prior to 1670.

The earliest developments were naturally in the production of wine and brandy, and from these a regular export business resulted, Cape wines, ports, sherries and pontacs were by no means uncommon in England during the latter part of the eighteenth century and were evidently held in some repute.

To-day, grapes, in addition to being used for wine-making, are produced for other specific purposes, such as the making of raisins, the export of table grapes to Europe, the production of currants, etc. Just as the peach, some variety of which may be found to fruit successfully over nearly the whole of South Africa, so there are certain types of vines which will grow and bear fruit in each province of the Union. They are not all of commercial importance and it may at once be stated that the only province in which the business of grape growing is thoroughly developed is that of the Cape.

The climate in the south-western portion, where the grape is most extensively grown, is an ideal one. It has the advantage, unshared by either of the other provinces, of having a winter rainfall and a perfectly dry, hot summer in which the fruit can develop to the extreme limit of perfection.

The altitude at which a large proportion of the choicest grapes in South Africa are grown ranges from about 200 feet at Constantia, near Cape Town, upwards, and most of the celebrated vine-growing areas in the Western Province are situated at under 1000 feet in altitude; they include Paarl, Stellenbosch, French Hoek, Wellington, Robertson, Worcester, and many others. Graaf Reinet, another celebrated vine-growing district, is situated in the Cape midlands about 2500 feet and has the summer rainfall common to that area. As it is rarely over 13 inches, no great damage is done to the grape crops.

Throughout the whole of the Cape vine districts the type of vine is the European and the same varieties are to be found as those which have made certain districts of France and Germany famous for wine, and others in Spain and Greece for raisins and currants. Varieties which are amongst the favourite ones of Italy do not appear to be as popular.

In the other provinces of the Union rain falls frequently during the summer months at the time during which the grapes should be ripening, and as a consequence the berries crack and favourable conditions for disease are engendered. The cultivation of the vine is not general in the Transvaal, though there are a few isolated instances where, in selected spots, a successful vineyard may be found and where passable wine has been made in a favourable season. It has also happened that owing to bad weather the wine has had to be turned into vinegar or perhaps brandy. Such vines as are grown commercially are mostly of the European varieties. Natal and the Orange Free State do not lay claim to being vine-growing areas.

In addition to the European sorts one may find vines of North American origin, amongst them the Catawba, Concord, Herbemont, Isabella are the best known, though there are numerous others, and as all of these are particularly hardy, they will grow and fruit successfully in Natal and other parts of the Union where vines of the European types are not a success. These American vines are not as subject to disease as the European ones and will bear large crops of fruit which will ripen during the summer rains when other classes of grapes would succumb.

Another type of vine must be mentioned, the American *Phylloxera*-resistant wild vine. These are non-bearers of acceptable fruit, such as they do bear being small and unattractive both as to size of bunch and berry, but they have the ability to resist the attacks of the *Phylloxera* insect, and as our large Cape vineyards of the present day are all, or nearly all, grafted on some one or other kind of this American wild vine, it will at once be seen what an important part these fill in the economy of viticulture.

Seeing that this book pretends to nothing beyond the operations of the ordinary fruit-grower, it is not intended to touch upon the question of wine-making or the culture of wine grapes, though allusions to certain varieties are unavoidable.

The general question of the establishment of vineyards, the practices in vogue, methods of pruning, cultivation, etc., together with the varieties of grapes suitable for table use, drying purposes and export will be touched upon.

Soils and Situations.—The grape vine will grow and produce good crops on many different classes of soil. It often happens that very

poor soils produce grapes of the highest class, and this is more especially the case with those used for wine-making.

For whatever purpose the grapes are grown, whether for wine, table, raisins or currants, it may safely be stated that in all soils this question of drainage requires close attention. Actual depth of soil is not of paramount importance, some of the best grapes are grown on soils of less than 4 feet deep and often under 3 feet.

The alluvial deposits offer, as a rule, soils which are rich and mellow, and these are most acceptable in the case of table grapes, where large-sized berries are desired. Mile upon mile of rich silt deposit, often underlaid with lime rubble and as level as a billiard table, may be found in the Karroo, and none will produce better raisins, currants, or sultanas. The necessary heat is present to develop a full sugar content, and it may be said that these Karroo soils are probably better adapted to the production of dried grapes in some one or other form than any other we have.

Table and wine varieties have been specialised in for a good many years past in the Western Province of the Cape, and it has been found that amongst table sorts which are produced there chiefly for export those grown in the lower-lying sections have neither the colour, flavour nor carrying qualities of the foothill grown grapes. Weight of fruit and size of berry and bunch may be achieved in the heavier valley lands, but as a rule this is done at the expense of quality. Briefly, it is a question of this *versus* quantity, and it has to be decided which to go in for. There are some kinds of table grapes which do exceedingly well in the valleys and generally the yield is heavier. It depends, therefore, on individual tastes and ideas as to what course to pursue, whether to go in for the very highest class of choice table grapes on the hill slopes or the more heavily yielding but possibly inferior quality produced on the lower-lying lands—each has its supporters.

Table Grapes.—The export of choice table grapes to England has become a very large business. Commencing in earnest during the early years of the present century it has grown from almost nothing in 1900 to 261,339 boxes, valued at £60,140, in 1924; this is the result of twenty-four years' expansion. The bulk of the grapes exported have come from the immediate vicinity of Cape Town, *i.e.*, Constantia and surrounding districts, though growers from and around Worcester, and even further away, make regular annual shipments.

Raisins, Sultanas, Zante Currants and Dried Grapes.—The production of dried grapes of all kinds has also assumed large proportions. Raisins are principally made in the districts of Worcester, Montagu, Robertson and Wellington, as also are sultanas.

Currants, frequently termed Zante Currants, from their con-

nection with the celebrated district in Greece of that name, are not grown in large quantities in any part of the Union. Interest appears to have focussed more on sultanas and raisins. Yet there are areas where the necessary conditions suitable for the growth of the currant are to be found, and it is but a question of time when this further grape product will take its place with the others.

Dried Grapes.—During recent years large quantities of dried grapes of varieties other than those generally used for raisin-making, consisting principally of Hermitage and a few other wine sorts, have been produced. The destination of large quantities of these has been the United States of America.

Propagation of the Vine.—The ordinary method of propagating the vine formerly was by means of cuttings, and this was an easy, rapid and successful process. To a limited extent the practice is continued to-day, but owing to the ravages of the *Phylloxera* insect the use of American resistant vines became imperative and general. That insect necessitated grafting the European or commercial varieties on American wild vines of the resistant type. The old-fashioned delightfully simple way of putting a cutting in the ground of the required variety with the knowledge that in a couple of years one would get grapes of the sort wanted is now only practised by very few, and the argument used is that by the time *Phylloxera* has destroyed the vine it will have paid all it was intended to do, and more can be planted.

The vine may also be propagated by means of layers, eyes (buds) and seeds. The latter is rarely practised, excepting with the object of originating a new variety. Propagation by means of "eyes" or single buds, whilst perfectly feasible, has but few supporters and is only justified when it is necessary to produce large numbers of a given sort in short supply. Really this method is only the use of an attenuated cutting, as the eye is cut with a short piece of the cane left attached at either end.

Propagation by layers is not common, but may be highly successful. It is useful to replace a vine which may have died in a vineyard, the idea being to allow a branch of an ordinary adjacent vine to grow to the length required, then to bring it down and make an inlayer of it, bringing the tip of the branch up in the spot where it may be required.

Propagation by Cuttings.—All the species of *Vinifera* (the European grape) root readily, and cuttings may be taken during June or July. As a rule, they may be about 16 inches long, more or less, depending on the soil in which they are planted and the amount of moisture supply. If land is fairly moist the cuttings may be less than 16 inches long. All cuttings are made by making the bottom end of the cutting immediately adjoining and below a bud

or node, thus the centre from which the roots spring is in the best position to provide them, that is, at the very bottom of the plant, although roots are thrown out from the other nodes. The tip of the cutting may be removed about half an inch above the bud from which the first leaves will issue. Cuttings are often taken at pruning time and they should be selected with care, choosing those of well-ripened, healthy canes and always from wood which has borne fruit, the more bunches the better. It is customary to plant cuttings in nursery rows in order to get them rooted prior to planting out in a permanent position. The rows may be any convenient length and about 4 feet apart. For this purpose a fairly good and moist soil should be selected and in a situation with a view to shelter from high winds. The cuttings at the end of the first year will need pruning and after that are ready for removal to their destination.

American Resistant Cuttings on which it is intended to graft varieties of commercial value may be planted in the same way as the above. There are a very large number of different sorts of these and their suitability as graft carriers is now more fully understood than in the early days when they were first introduced and experience with regard to their use was entirely lacking. Certain kinds are recognised as being suited to some soils and as having a distinct affinity for some kind of grape; whilst others might be quite unsuitable. It is not proposed to enter into a long dissertation on this subject, which is excellently dealt with in various publications by the Agricultural Department. American resistant cuttings are raised specially for the purpose of being used as stocks for European varieties of grapes and may be allowed to remain in the nursery for a year to secure some root system. Scions and stocks are selected when grafting time comes, usually in June or July, of about the same thickness, and grafting is done by means of the whip graft. The vines after grafting are set out in nursery rows as above mentioned, but after planting, the earth is drawn up so as almost completely to cover the vines the whole length of the row, the only vestige allowed to remain in sight being the very extreme tip of the cutting. The soil is kept moist and free from weeds until growth has well started, when the earth is removed from round the vines in order to prevent the growth of roots from the scions. This would very likely occur if the precaution were not taken and the vine would then draw its sustenance from a non-resistant root, with the result that it would be subject to the attacks of *Phylloxera*.

Many thousands of cuttings are grafted—simply as cuttings—with the required varieties and planted out in nursery rows and this is a very favourite practice. Possibly not as many grow as

when the cuttings have been allowed to root, but the percentage is high enough to be quite satisfactory; it may be said this is the method which is most generally in use.

The planting out in the vineyard of American stocks, either rooted or as cuttings, with the object of grafting them at some later date is sometimes, though not often, practised. The author has had excellent results from this *in situ* grafting, as it is called. In the working over of vines in this condition it is found that many different sizes of wood are present, in some cases the stocks will have grown to be an inch or more thick, in others not half an inch, the smaller ones are grafted by means of the whip graft, and the larger by the use of the cleft graft; in all cases the graft should be tied over with raffia and soil heaped over the whole with the exception of the very tip of the scion. After the young vines have grown out freely, the same precautions have to be taken to prevent scion rooting as previously mentioned, *i.e.*, the earth must be drawn down from round the vine and the graft left exposed and above the level of the ground. When this is done no trouble can occur.

Propagation by Single "Eyes."—This is only warranted when it is desired to propagate a particular variety which may be rare or uncommon. As each eye will produce a plant, it will be seen that the advantage of this method of propagating is considerable. Many plants of the variety needed can be produced more quickly and cheaply than by any other means. Of course, if of European or commercial varieties they would not be resistant.

The eyes are cut with from $\frac{1}{2}$ to $\frac{3}{4}$ an inch of wood left on either side and planted bud upwards, in rows, and covered with about an inch of soil. They start readily, and only need to be kept moist to make a satisfactory growth.

All cuttings, of whatever sort, will throw out roots at each node, unless the eyes are cut out, so that when a few years old they may have two or three sets of roots one above the other, just how many sets will depend on the length of the cutting and the distance between nodes. It is found that short cuttings as a rule produce most vigorous growing vines, the root system appears to be better developed, and the vitality of the plant is not dissipated by the production of so many sets of roots.

Preparation and Laying Out of Vineyard.—Without exception of any kind whatever, it is definitely stated that in South Africa all land destined for use as a vineyard should be trenched. This is not the experience of other countries, and such a thing is regarded as out of the question in California, where many thousands of acres are planted to vines; however, experience has shown us the folly of planting vines in South Africa without trenching the land first. Practically all the best vineyards in the Cape have been prepared

Delta

in this way and its necessity has frequently been demonstrated notwithstanding the advocates of sub-soiling and planting in trenches possibly 18 inches wide by the same depth. The practice of trenching or "delving" the land is still regarded as the soundest and most economical method of preparing land for a commercial vineyard. The expense is large at first, but the results are worth ten times the sum spent. Trenching consists of turning over the soil in the entire field to a depth of from 2 feet 6 inches to 3 feet 6 inches, bringing the bottom soil to the top and *vice versa*. This work is usually done by coloured Cape contractors, who employ "Cape boys" to do the work and it may here be said that these same "boys" are the best wielders of a spade to be found anywhere. Trenching means making the whole area of the field into one big hole, without any sides for the roots to penetrate, and the growth made by vines of all kinds in land trenched in this way is simply enormous.

Trenching has been found to be especially beneficial in connection with the resistant American vines and the author had actual experience of a growth of 10 feet in the first season, when a flood in the Great Berg River washed away part of a recently planted vineyard but left the vines in place, held by their enormous root systems.

The operation of trenching leaves the land in a perfectly level state and ready for the immediate commencement of planting operations, which usually take place in June or July. In laying out a vineyard the first consideration is to arrange the size of the blocks and the roads necessary to carry the crop to the pack-house or cellar, as the case may be. Easy access is necessary so that pickers may not waste too much time in walking backwards and forwards to the roads. That means that the blocks must not be too large. On the other hand, if blocks are too small the area occupied by the roads also becomes a matter for consideration. Probably a 5-acre block would be a generally acceptable size. The roads serve as turning points for animals when cultivating as well as being arteries for the incoming of fertilisers, etc., and the carting away of the crop of grapes besides prunings when necessary.

The distance between the vines and the manner of training adopted depend on the purpose for which the grapes are required. Formerly, before the day of the export of table grapes came, it was the custom to plant vines very closely together, from $2\frac{1}{2}$ to $3\frac{1}{2}$ feet apart being about the average distance. In 1900, the author planted the first large vineyard with vines set out at a distance of 5×6 feet apart and the great distance between the vines called forth immediate disapproving remarks. However, as time went on the distance apart in planting grew to be greater and now, for

many classes of wine, table and raisin grapes a distance of 5 feet and more is allowed. Planting may be done either on the square system, which is in general use, or in rows, the latter being compulsory when vines are trained on trellises. When planted in squares the different distances apart give the following numbers of vines per acre:—

3	× 3	feet	vines per acre		4840
3½	× 3½	,,	,,	,,	3566
4	× 4	,,	,,	,,	2722
5	× 5	,,	,,	,,	1742
5	× 6	,,	,,	,,	1452
6	× 6	,,	,,	,,	1210
7	× 7	,,	,,	,,	889
8	× 8	,,	,,	,,	680

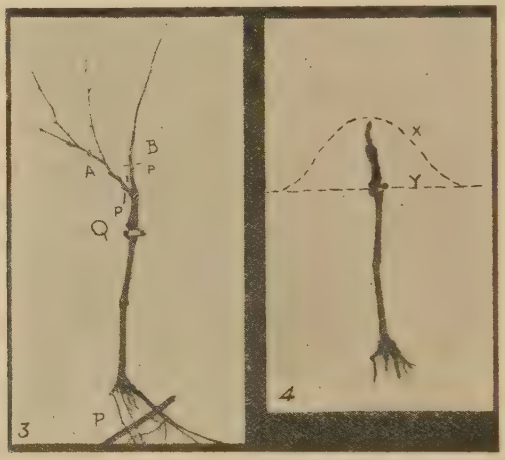
The laying out of a vineyard for planting is a simple matter once the question of style of planting and distance apart have been settled. For setting out the vines in squares, the sides of the land selected are pegged off at intervals according to the distance required. A wire is stretched across the land from one peg to a corresponding one exactly opposite to it on the other side of the land; this wire is marked with a lump of solder at the necessary intervals. Each solder mark indicates the spot on which the vine is to be planted and the wire is moved along the whole length of the land until the work is completed. The actual planting is usually done by men with spades; they drive the spades into the ground concave side towards them, bringing the handle exactly opposite the spot occupied by the solder mark—each planter is careful to put his spade into the ground on the side of the wire nearest him; they then work the handle backwards and forwards lightly and when the cavity thus formed is deep enough they place the vine in the ground carefully at the back of the spade, and close the space up, first by bringing the soil closely up to the vine by the use of the spade and then by tramping it round with the feet. It is customary to use as many planters as possible and when a good gang is got together the work proceeds apace.

What is termed "Quincunx" planting is sometimes made use of. It is also a simple method and represents, instead of four vines planted in a square at equal distance apart, the addition of one vine in the centre of the four. The alteration of the side pegs is all that is needed for this method of planting. Instead of being at the end of the rows, the first peg is placed just in the centre of the square and the measurements are made from there.

Planting in Rows for Trellis.—Marking out may be done in the

same way as previously mentioned; there is no better or easier way. Vines so planted run to the acre as follows:—

4 × 6	feet	1816 vines per acre
4 × 7	,,	1556 ,, ,, ,,
4 × 8	,,	1360 ,, ,, ,,
5 × 8	,,	1090 ,, ,, ,,
5 × 9	,,	968 ,, ,, ,,
6 × 10	,,	726 ,, ,, ,,
8 × 10	,,	545 ,, ,, ,,



3. Shows a young vine as received from nursery. Side shoot A should be severed at dotted line P, shoot B should be severed at dotted line P, leaving a vine with two eyes. The root-system is trimmed and pruned as shown at P. Q shows the graft union, and any roots arising from this point should be cut clean away.

4. A vine as planted in the vineyard. Y represents the ground-surface, and when planting the union mark should be about ½ in. above this. After planting, to protect the young growths from the heat and at the same time give the young vine rigidity, X represents the mound of fine sand or earth thrown up for protection.

[*Photos by L. Perkins.*

Trellises are sometimes made to run from north to south with the idea that in this way they will get the full benefit of the sun's rays all day. It is quite the best way to set them, provided that the prevailing winds blow from north to south also or approximately so, but it is not considered advisable to plant trellises to run straight across the wind; they do not get the full benefit of the air currents and mildews and other troubles of a similar nature are apt to follow.

Training and Pruning.—The training of the young vine depends on the methods to be observed in its future growth. If in bush form, then the vine will be trained to produce a stem with about three or four branches. This cannot be done at once, but should

5. A one-year-old vine after first winter pruning.
6. A two-year-old vine after second winter pruning.
7. A four-year-old vine after fourth winter pruning.
8. Demonstrates the extremities of secondary arms of bush vines: (1) pruned long; (2) pruned short; (3) pruned half long.

[*Photos by L. Perkins.*

be the result of about three years' cutting, with that object in view all the time. The vine always bears on the new wood which is provided from the growth of the previous season. Growths or suckers springing from the old wood of the vine will not bear, so

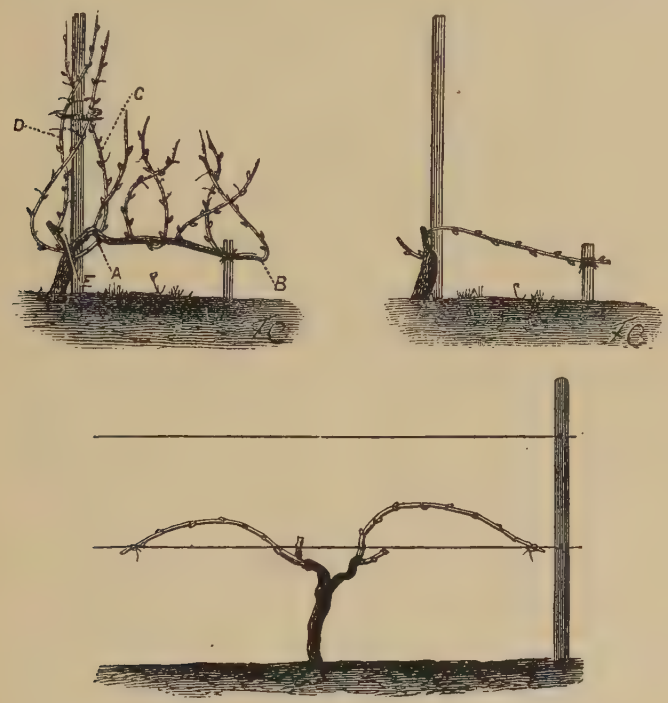
they must always be removed. It follows that the production of bearing wood must be carefully kept in view. This is usually attained by the removal at pruning time (July) of all superfluous growths and the cutting back of those which have been selected to remain to a couple of eyes. Every year the vine becomes larger and may eventually have six or more branches. In the case of table grapes trained in bush style, bunches should be carried higher up and further from the ground than is necessary in the case of wine or raisin varieties, the object being to keep them clean and free from dust and well sheltered by the leaves.

A WELL-ESTABLISHED BUSH VINE PRUNED SHORT.

With raisin and wine grapes a closer proximity to the ground results in a higher sugar development. It must not be thought that all kinds of grapes appreciate the same kind of pruning, some have a rooted objection to bearing when pruned short. The sultanas, Zante currants, Almeiras and most of the North American sorts prefer long to short pruning.

Sultanas and currants are always grown on a trellis. Two wires (No. 10 galvanised) are sufficient; the lower about 2 feet from the ground and the other about 18 inches above it. North and south rows are best where possible. Stems of the vines are longer in this method of training and may be brought up to within 6 or 8 inches of the lower wire before allowing any branches; two are selected and trained along the bottom wire, later on a couple more may be brought up and trained along the top wires and these are pruned back heavily annually as shown. Although many thousands of boxes of grapes grown on bush-trained vines are exported annually, the best and most successful of our growers train their vines on a T-shaped trellis. This trellis should be about 4 feet 6 inches high and consist of three wires, the lower one being about 2 feet from the ground. The two top ones are strung along cross-pieces, just as one may see on a telegraph pole from the ends of the rows, and these should be some 2 feet apart more or less. Occasionally a fourth wire is used 18 inches above the bottom one, but this is not the rule. The vines are trained so that the bearing canes—the

new growths—hang over and down from the two top wires. The bunches of grapes are thus sheltered and distributed in better position for the operation of thinning to take place. Galvanised wire should be used, not ordinary iron wire, and care taken to see that the standards are strong enough to stand up under the weight of fruit. Special attention should be given to the end posts in the rows, which should be extra strong, and each of these should be



ORDINARY CANE PRUNING FOR TRELLIS.

[From *The Victoria Handbook of Viticulture.*

safely anchored in the ground. The finest table grapes are grown in this way, and with care in fertilising, cultivating and thinning very high returns are secured.

Suckering and Topping.—The removal of all suckers which may appear round the stem of the vine is essential in order that no unwanted growths may be produced. This practice is the more necessary now than formerly, on account of the very general use of resistant American stocks.

Should suckers of these be allowed to grow the result might

easily be that the grafted variety would be smothered by the growths, so readily and quickly do these wild types of vines grow. On the other hand, should suckers of the European variety be permitted, there is always the possibility of their striking downwards and taking root, thus rendering the vine no longer *Phylloxera* proof. For this reason it is necessary to go round the vines occasionally and examine them for growths of this kind during the early stages of the growing period. In suckering some mature vines, it may sometimes be found that a shoot will appear which it is desirable to retain for the sake of the symmetrical appearance of the vine, or in place of a branch which has been injured in cultivation. In such cases the shoot is treated so as eventually to make it into a perfect branch and is cut back at the winter pruning with that object in view. Suckering may be repeated as often as needed.

Topping of the vines is done during the early seasonal growth. Some vineyardists undertake this work when a certain number of leaves have been thrown out beyond the topmost blossom on the canes. In any case it is well to get it done before the canes get too old and the wood has commenced to harden. The common practice in the case of bush-grown vines is to slash the tender tops off with a sickle or piece of tough bamboo cut to the right length and sharpened to an edge.

In the case of choice grapes for export, grown on trellises, this practice may also be followed, but some careful growers will spend more time over the work and pinch off the young shoots in exactly the right spot with the thumb and finger.

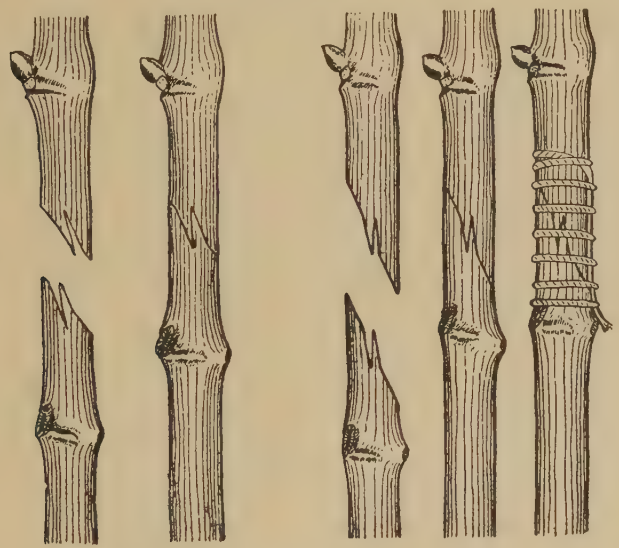
One object in topping is to provide shade in the shape of the extra leaves induced and so prevent injury from the hot sun to the crop; topping also tends to strengthen the growth of the canes. As a rule, topping is done at least twice in the season and sometimes more frequently.

Grafting the Vine.—The grafting of the vine has become a necessity since the introduction of American resistant stocks. There are different ways of doing this work, but the great bulk of it is done by one or the other of two methods, the whip graft or the cleft graft. Whip grafting is particularly suitable to all growths up to $\frac{1}{2}$ inch diameter, and for these it is principally in use. Larger growths of from $\frac{3}{4}$ inch upwards are most successfully handled by means of the cleft graft; in fact no vine is so large that it cannot be worked over by this method.

As a rule, grafting the vine may be done at any time during its dormant period, the months of June, July and August being naturally those which the greatest period of dormancy is found.

The bulk of the work is done in order to produce vines with resistant roots. Many thousands are grafted annually. The work is, as a rule, done on the farms, and "Cape boys" become very

~~expert at it~~. Whether cuttings pure and simple, unrooted, should be used for planting, or rooted cuttings, *i.e.*, cuttings which have been in the ground for a year and so thrown out roots, are used, the operation of grafting is the same and consists practically always in the use of the whip graft. This is an easy and rapid method and consists of the cutting of the stock and scions in exactly the same manner and the fitting of one into the other as shown. It is necessary to bind the grafts over with raffia grass as if this is not done there is a possibility of the grafts drying out, and this is especially the case where the stocks and scions are not of the same size.



A. Modified whip graft. B. Ordinary whip graft.
After L. O. Barnet, University of California.

The cleft graft is used on larger vines perhaps when resistant vines have been planted *in situ* or possibly for working over some undesirable variety. The operation is simple, yet requires a certain amount of care. The vine to be grafted is sawn off a little above the level of the soil, the split is made with a short, heavy, strong-bladed knife or other suitable tool and the scion is inserted into the cleft so made so that the under barks of both stock and scion come well into contact with each other. The greater the extent of the contact formed the better and more readily does union take place, but even with such slight contact as may be formed, should the inner barks of the scion and stock simply cross each other at a certain spot this is sufficient to form a satisfactory union. The

scions should be so cut that they may fit comfortably into the cleft. It is usual to make them into wedges with a bevel about an inch in length or a little more. This should be so cut that the outside edge may be very slightly thicker than the inside and so make sure of cambium contact.

A scion may have from one to three or even more eyes. Two is the usual number and the lower of these when the scion is in place should be slightly below the level of the top of the stock. Very large stocks may be made to carry two or even more scions if considered necessary.

CLEFT GRAFT BEFORE BINDING—AFTER BIOLETTI.

c, scion; *cc*, completed graft.

There are many other grafting methods which may be found described in works devoted exclusively to viticulture, but those mentioned are the most reliable and best suited to our requirements.

Budding the vine may also be practised, and there are many new ways of doing this work. General practice in South Africa, however, is to work entirely by grafting methods, using one of those described above.

Cultivation.—Formerly vineyards at the Cape were cultivated entirely by hand—a relic of the past days of slave labour. The "Cape boy," that past master in the handling of a spade, dug up the whole of the vineyard, turning under every weed and getting close to each vine. As a rule, it was customary to have all winter work, such as pruning and digging the vineyard, completed by July 31st. This practice of digging the vineyard is still continued in some parts and there is much to be said in its favour. As a complete sceptic, the author, many years ago, once tried digging *versus* horse and mule cultivation, and was forced to acknowledge that the old-fashioned method had much to recommend it.

Cultivation may be taken to embrace all that which is necessary to the well-being of the vine and consists of a winter ploughing and summer cleaning of the land when methods other than those of hand labour are employed. It is necessary that the soil should be kept loose and in mellow condition, clean and free from weeds during the summer months. The winter ploughing should be done as soon after pruning time as possible, the straggling canes

are all out of the way and it is possible to get closer to the vines. A single horse (or mule) and a 10-inch plough are all that is required as it is not necessary to plough too deeply. After the plough comes the harrow and then the vines must be dug or hoed round to free them from close-growing weeds. Summer cultivation consists of the stirring of the soil with an ordinary one-horse cultivator, or when hand labour is employed with the Dutch hoe or skoffel. The latter are not as suitable as the former, as the land is not loosened to the same extent by their use. No work amongst the vines should be done during blossoming time.

Fertilisation.—The grape vine is a gross feeder, and responds readily to liberal treatment. This statement applies more particularly to those varieties which are grown for the production of table grapes and raisins.

It was popularly supposed that wine grapes appreciated soils of a poorer nature and undoubtedly some poor soils do produce (in conjunction with suitable climates) a good wine. However, for other classes of grapes, soils can hardly be made too rich. The fruit grown on good soil is better in every way, the bunches and berries are both finer and the grapes, if used for export, are better carriers. In addition, the growth of the vines is more vigorous and they are also less liable to diseases of any kind.

The size of both berries and bunches has much to do with the prices realised for table grapes, and the same remark holds good, though not perhaps to the same extent, in the case of raisin grapes. No vineyard soil on which these classes of grapes are grown can possibly maintain its fertility unless manuring in some form or other is resorted to. This is not to be wondered at when the enormous crops produced annually are considered. The yearly production of wood makes also a serious drain on the soil.

The supply, therefore, of aids to fertility has to be studied. As with fruit trees of all kinds, so with the vine, the requirements of the soil are principally nitrogen, potash, phosphorus. The supply of nitrogen by the growth of leguminous plants of some kind between the rows of vines is at once economical and beneficial. Planting of such things as lupins, clover, beans of some kind or cow peas not only helps to supply nitrogen, but when ploughed under improves the mechanical condition of the ground very materially. The humus they supply is directly beneficial in that it enables the moisture contents of the soil to be more readily maintained.

Sulphate of ammonia in moderate quantities may also be used if the cover cropping is deemed insufficient to supply all the nitrogen required—by moderate quantities an amount not exceeding 500 lb. per acre is meant.

Superphosphates or ground bone may be used to provide the necessary phosphoric acid, and this is perhaps the most important

constituent in the wood of the vine. Without sufficient supply of this, it is to be feared that no grapes will carry properly and certainly not as well as would happen were there a plentiful quantity of this item.

Potash in the form of the sulphate is a convenient means of applying this constituent. There are, however, other ways and it is quite in order for wood ashes to be saved and used as a source of potash. The quantities to be given are left to the grower, who from actual knowledge of his land should be able to decide best as to requirements. In soils deficient in lime, up to 1000 lb. per acre may safely be added.

Irrigated vineyards require more in the way of fertilisers than others which are conducted by means of dry cultivation. The longer period during which growth is proceeding and the greater demand on the constitution of the vine owing to its heavier yields require more manuring than is ordinarily the case.

An old custom, and quite a sound one, formerly in use was to dig a trench between every fourth row of vines and deposit therein all the winter prunings; this was continued for four years, taking a fresh row and digging a fresh trench every year. At the expiry of that period, the first lot of prunings buried had become rotten and the process was open to repetition or fresh trenches might be started at right angles to the original ones; the digging of the trenches alone served a useful purpose in loosening up the soil and rendering it easily permeable by the vine roots.

Irrigation.—In the districts which produce the choicest grapes for the export business and specialise in that particular line no irrigation is carried on. These lie principally in the neighbourhood of the Western Province of the Cape and rejoice in a rainfall of from 15 inches upwards, there is therefore little need to irrigate; indeed it is questionable whether the application of water would be of benefit to the grapes. Any increase in the size of the individual berry might be discounted by an accompanying lack of carrying qualities owing to the superabundance of water in the fruit.

In those districts which are situated further inland and away from the heavier rainfall areas the matter is a different one. In the districts of Robertson, Montagu, Worcester, Graaf Reinet, where raisin grapes and sultanas are produced principally, irrigation is freely practised. The larger berries obtained from the use of water make, of course, a bigger raisin and this has a considerable bearing on the price realised for the crop. The sultana is always better grown where irrigation is possible. In fact, the best sultanas are grown under climatic conditions where, as a rule, it is compulsory to resort to the use of water to mature the fruit properly. Coastal-grown sultanas do not compare with those grown inland in a hotter and naturally drier climate.

Varieties of Table Grapes: *Barbarossa*—A particularly strong grower and hardy vine, bearing bunches of the largest size with large dark purple berries; may be exported, and is a good vine for training on pergolas or trellises. Ripens February or March depending on locality. May be planted throughout the Union. Its free-growing character makes it a favourite, though the quality of the fruit is not first class.

Black Prince.—A hardy, strong-growing vine, with large bunches; berries round, large, dark purple to black when ripe, loosely placed on the bunch. This is one of the best of the early grapes. It has been exported, but the quality is such that not much demand exists for it. Ripens towards end December or early January.

Black Hamburg.—One of the most popular and favourite varieties of black grapes, but not largely grown in South Africa. Vine a good grower, bearing large bunches of big black berries, roundish-oval in shape with rather thin skin. Colour dark purple to black when ripe.

Crystal.—A favourite grape at the Cape for domestic and local market purposes. Vine a strong grower, does best on trellis, bears good and regular crops of large-sized, round, white grapes of good flavour. Not an export grape and does best in regions of winter rainfall. Red crystal grapes are also grown, but to a far less extent.

Flame Tokay.—A healthy, vigorous-growing vine; leaves large, dark green in colour, sometimes tinted brown. Bunches of the very largest size, heavily shouldered and compact with rather large oval-shaped berries. Colour a beautiful pinky red with light bloom. Grown principally in the neighbourhood of Constantia. Carries well, but is not a favourite export grape and is considered somewhat difficult to grow to perfection.

Gros Colman.—Vine a fairly good grower and heavy bearer of very fine large round berries. Bunches are of medium size and are frequently double. It is one of the handsomest of all the black grapes we have. It is a good shipper, bringing top prices when received in good condition, but is liable to crack if exposed to rain. Berries are found occasionally measuring 5 inches round. This grape is one of the most profitable to plant, especially in favourable situations, such, for instance, as those which are free from heavy dews and rainfall during ripening period, which is mid-season.

Gros Maroc.—This is another grape with very large black berries. They are round, firm-fleshed with a nice bloom. Growth fairly vigorous and the vine may be best grown on trellis. May be classed as quite a satisfactory export grape.

Hanepot.—This is the celebrated White Muscat of Alexandria and is probably more extensively grown than any other grape. It is certainly distributed over a wider area, and in its varieties is

used for every purpose to which a grape can be put. It is used for wine-making, producing what is called "Angelica" in some countries, also for raisin-making and is one of the choicest of table grapes. It is to be had in either the white, red or black varieties. The latter is not often seen in South Africa. As an export grape it is hard to beat and when received in perfect condition fetches good prices. The vines may be grown either on trellis or in bush form—the latter is preferable, especially for raisin purposes; they are not too vigorous growers but are healthy and good bearers. The bunches are medium to large, compact, and carry berries which are whitish at first, but as they become properly ripe put on a yellowish-brown appearance and it is at this stage that the flavour is at its best. No other grape has quite the same musky taste. Canon Hall Muscat and Gordo Blanco have both of them a similar flavour and appearance and are seedlings of the Hanepot. They are also used very largely for the production of raisins.

Hermitage.—This grape is used largely for both wine and table purposes. The vine is a medium grower, but a very heavy bearer of large-sized bunches of slightly oval black berries. It is a favourite grape for export and about the first sent over each season in large quantities. As a rule it fetches good prices. It does best when trained in bush form.

Karroo Belle.—This grape is a South African variety, having been raised in Aberdeen by the late Mr. Eagle. It is not widely distributed and is worth more attention than it receives. When grown on trellis the vine attains large proportions and produces a very large oval-shaped berry similar in colour to Flame Tokay. Bunches are of large to medium size. Ripens February.

Raisin Blanc.—A strong, healthy vigorous grower, largely planted in the Western Province of the Cape. It may be grown either in bush form or on trellis. Bears large compact bunches of greenish-white grapes of good size and flavour. Suitable for export and local markets.

Syrian or Canaan Grape.—This is supposed to be the grape found by the Jews who were sent to spy out the land of Canaan and mentioned in the Bible. The bunches were so large that they had to be carried on a staff between two men. The vine is a strong, hardy grower and has borne very large bunches (up to 18 lb. in weight) in the vineyard of the late Senator Marks near Pretoria. They have large oval berries similar in colour to Hanepot and becoming, like that grape, of dark brownish-yellow when ripe. The vine is not cultivated to any extent.

Red Muscadel.—This and the White Muscadel are about the earliest grapes to ripen in South Africa, often being well in evidence before Christmas. The vines should always be trained in trellis

form. They are not very strong growers, but bear regular and heavy crops of fruit. Bunches are small and elongated, bearing small, round berries either white or red, according to variety. They have the slightest musky taste and are no use for anything except local markets. As the earliest grape they often fetch more than a better grape does ripening at a later date.

Waltham Cross.—One of the handsomest of the white grapes, becoming pale golden-yellow when fully ripe. Its origin is partly Muscat and it has some of the characteristic flavour of that type of grape. The vine is not a very strong grower and prefers trellis to bush culture. Bunches are large and loose. Berries large and oval-shaped, with slight bloom. Waltham makes an excellent raisin grape and is also a favourite for export, as it has first-class carrying qualities. Ripens late. All the above have been grown in different parts of South Africa, principally at the Cape, for numbers of years. The following varieties are more recent introductions, and the author is indebted to Mr. A. M. de Plessis, viticultural assistant, for the description given.

Bonnet de Retord.—A strong-growing vine; rather shy bearer; does best pruned long on trellises. Bunches medium size, compact berries medium size oval. Flesh firm, skin thick and tough. A hardy grape with little flavour, is attractive only on account of its striped berries, which distinguish it from other varieties. Has been successfully exported.

Gros Noir du Beni-Abbes.—Vine very vigorous grower; does best on trellis; should be pruned long and late. Bunches large with loose berries, due to non-setting of fruit. Berries very large, short oval, dark purple to black in colour and covered with a blue bloom. Ripens late. The grape is an excellent one for export.

Henab Turki.—This is a medium strong-growing vine, bearing medium to large-sized bunches of large, roundish-oval, dark purple to black berries. Bears well when pruned short. It is a first-class export grape, has several crops a year, of which all but the first should be removed if the fruit is to be exported.

Molinera Gorda.—A very vigorous-growing vine. Not a heavy bearer. Bunches large and loose, berries round, hard with thick skin. Ripens about same time as Hermitage. Requires long pruning. Is a good keeper and export grape, also good for local markets.

Prune de Cazouls.—A strong-growing vine and a good bearer, which may be pruned either long or short. Bunches medium size, rather long and compact, berries large, oval with firm flesh and thick skin. Black when fully ripe. Is a fine export grape. Ripens late.

Rosaki di Smyrna.—Vine is a medium grower and bearer, requires

short pruning and carries bunches of medium to large size, with large bright yellowish-green to golden-yellow berries when ripe. Berries are oval, hard and sweet. A good export grape. Ripens rather before Hanepot.

Tribodo Nero.—A poor grower but heavy bearer and requires careful attention to prevent overbearing; must be pruned short. Bunches are of medium size, compact with large, oval berries, yellowish-green when ripe; flesh firm and without flavour. Will export. Ripens late.

Most if not all of the above were introduced by Mr. Perold, late of Elsenburg College, whose book on viticulture is an outstanding work for the South African vineyardist.

The Ohanez or Almeira Grape.—This has been grown in South African vineyards for many years past. It is the grape one sees packed in cork dust in barrels and has no particular recommendation except that it ripens very late and has such a tough skin that it will carry anywhere. The vine is a rampant grower and must be trellis grown and subjected to long pruning if any crop is to be secured. Overhead trellises are sometimes used. Large crops are uncommon in South Africa and for this reason perhaps the variety has not been very extensively planted. The bunches are of fairly good size, sometimes quite large, carrying large, elongated, oval berries. Colour greenish-yellow until fully ripe, when they take on a golden tinge. There is also a red variety of this vine. Neither has any particularly outstanding good qualities excepting those mentioned, being poor, tough and flavourless. They do, however, fetch good prices on the market.

Zante Currants.—The "currants" of commerce when dried. This vine has a strong habit of growth and is a fairly good bearer. It must be grown only on a trellis and pruned long. The bunches are small, often double, and very compact. Berries are small and sweet, without seeds and almost black in colour.

American Phylloxera-*resisting Vines.*—The introduction of these took place in the Cape towards the close of the last century, when practically the whole of the existing vineyards had to be reconstructed on account of the destructive work of the *Phylloxera* insect.

Originally two distinct types of vines, the *Riparia* and *Rupestris*, were brought in as stocks and very soon their use became general. As time went on, it was found that certain varieties of European vines experienced no difficulty in forming a satisfactory union with one or other of these two types whilst others had little or no affinity for either the one or the other of the Americans. As a result, much work of an experimental nature took place and to-day, after over thirty-five years of solid endeavour, many other types of American resistant vines are to be found.

The suitability of stock to scion has been largely determined, as also has that of stocks to soils. Readers are referred to the viticultural section of the College of Agriculture at Elsenberg, Cape Province, for full details in connection with the requirements of any particular varieties of vine in which they may be interested.

Sultanas.—The sultanas grown in the Union are practically all of one type (Thompson's) and are used most exclusively for drying purposes. They produce the sultana of commerce.

The vine is a rampant grower and should always be grown on a trellis. The bunches are very long, sometimes up to 20 inches, and loosely formed. The berries are small and of oval shape and golden-yellow in colour when ripe. They are seedless with rather thick skin and make quite an acceptable table grape. Succeeds best in the Cape midlands.

North American Varieties.—These may be planted in almost any part of the Union. They are hardy and less susceptible to mildew or any other form of disease than grapes of European origin. They have all, to a greater or lesser extent, the perfume peculiar to these grapes. The term " foxy " has been, and not unsuitably, applied to it. They are all at their best in trellis form and are rarely grown in any other manner.

Catawba.—This grape comes from North Caroline, U.S.A., and is well known throughout South Africa, it is sometimes called " The Strawberry " grape. The vine is a free grower, bearing small to medium-sized bunches of rather small, round grapes. Colour red to dark red. Ripens late.

Concord.—This variety has the distinction of having a stone erected to the memory of its originator, Ephraim Wales Bull, who planted seeds of a wild Labrusca vine, found on the hillside near Concord, U.S.A., which, after being used for three generations of his family, became in 1849 the " Concord " grape. The vine has a similar growth to the Catawba. Bunches are larger and shouldered, leaves round, berries black and ripens late. This grape was introduced by the author at the request of Mr. Winshaw, of Stellenbosch, who has developed an industry in the making of unfermented wine from this particular grape.

Herbemont.—This vine is a strong grower and quickly covers ordinary trellis and pergola structures. Bunches are fairly large, berries dark purple covered with light bloom. They are of medium size and have a less pronounced flavour than some others of this class. It has been used as a stock for *Vinifera* varieties.

Isabella.—This vine is also a rapid grower, carrying loose bunches of rather small dark purple, oval-shaped grapes of typical foxy flavour. It was named after a lady, Mrs. Isabella Gibbs, of New York State, by whom it was introduced to the notice of cultivators.

CHAPTER XXV

NUTS GROWN IN SOUTH AFRICA

The Almond

The almond is indigenous to the African continent. It may be found in one form or other from the Cape to the extreme north. Bitter almond trees are common in the Northern Transvaal, and the district of Zoutpansberg affords some magnificent specimens. The different types are: the bitter almond, the peach almond, the hard, soft and paper-shelled, the two latter being the ones from which what we term " commercial varieties " are selected. Each is distinct, but all possess the main characteristics of their race.

Some years ago, the world's production of almonds was largely confined to Spain and other countries bordering on the Mediterranean Sea. With the development of the fruit industry in California, U.S.A., many plantings of almonds took place there, and as is usually the case in the beginning of a new industry, many of these undertakings proved unsuccessful. Still California eventually entered the world's markets as a producer of almonds, and as in the case of deciduous fruits developed many varieties which have come to be regarded as amongst the best procurable. Hard shell almonds have been grown in South Africa for many years, but until comparatively recently little effort has been made to produce the better varieties. The hard shelled one was probably the first to be introduced with other fruit trees of a deciduous nature to the Western Province of the Cape, and many fine specimens are still to be seen there, descendants of the original pioneers.

This favoured area was the home of the almond in South Africa for many years, and may still be regarded as its headquarters, although other portions of the Union are beginning to turn their attention to the growth of this beautiful and profitable tree. The almond is the first of all trees to burst into bloom in the spring of the year. Oftentimes it puts forth its flowers in July, and occasionally even in June, and this precocity has done much to prevent the more extended planting of the tree commercially. As an ornamental one for lawns, gardens and shrubberies it presents a beautiful sight with its solid masses of pinky-white blooms, but this extremely early flowering renders the blossoms liable to be destroyed

THE "BRITZ" ALMOND PROPAGATED BY NEL BROS., MONTAGU, CAPE PROVINCE.

by frost, and so the areas in which successful almond culture is possible are limited to those districts where frost is absent or almost so.

A further fact had militated against the wider development of the almond-growing industry, and that is the natural sterility of the blossoms of nearly all the varieties and the necessity (only recently fully realised) of cross-pollination by mixing up varieties when setting out the orchard. Even then it is of the utmost importance to plant suitable varieties in juxtaposition to each other. There is no doubt whatever that if these two factors had been fully realised thirty years ago, many thousands of almond trees would have been planted along with the deciduous fruit trees in the Western Province of the Cape. It has been lack of knowledge in the past which has rendered the growth of the tree less attractive than some others, for it is certain that if the almond had been proved a money-maker the planting of the tree would not have been neglected as it has.

Now that more light has been thrown on the subject, the planting of the almond commercially will probably take place on a larger scale, and this is likely to be hastened owing to the present shortage of the supply of nuts of all kinds. It is interesting to note that instead of exporting almonds, as the Union of South Africa should be in a position to do, our imports were:—

	Weight, lb.	Valued at
In 1920	201,250	£23,477
In 1921	205,083	17,106
In 1922	281,943	21,742
In 1923	282,055	16,199

The whole of this enormous quantity of almonds could have been supplied by South African growers.

Climates and Situations.—It has been shown that a frostless situation, or one almost so, is a *sine qua non* as far as a successful almond orchard is concerned. That places large areas of South Africa outside the pale at once. Frostless areas are to be found round the coast, from Zululand in the east to Namaqualand in the west and inland in the low veld of the Transvaal, from Barberton to the Limpopo, embracing the districts of Zoutpansberg, Pietersburg, Lydenberg and Barberton; there are others immediately adjoining these which are subject to occasional frosts, and planting in such may be undertaken if one does not mind the extra risk.

Low-lying situations are of necessity the coldest and are liable to be dampest and most subject to mist and fog, and for these reasons the almond should be planted for preference on higher land. Foothills with a northern and eastern exposure are ideal for the almond. If shelter from high winds is obtainable, all the better.

The almond will grow in almost any kind of soil provided that

it is deep and well drained. The most suitable, however, are to be found in somewhat lightish loams with sufficient depth for the roots to forage for moisture; the tree is a deep-rooted one, so the deeper the soil the better. It will flourish also in soils which contain a proportion of gravel and stones if the latter are not too much in evidence. A dry rather than a damp situation is to be preferred, yet it must not be thought that the almond tree objects to water; an ordinary coastal rainfall of from 25 inches to perhaps a little above provides sufficient moisture for the growing needs of the tree. In those areas where from 15 to 20 inches is the maximum, the almond tree requires irrigation a couple of times in the season. The red loams so frequently in evidence are most suitable for the tree. Soils with hard pan beneath and turf soils may be left out.

The majority of almonds supplied by our nurserymen and planted in this country are grown on peach roots, and this has as a general rule proved quite suitable. Both the peach and almond are quick-growing trees, the union is perfect, and as the trees are very nearly related, affinity is assured.

There are probably a few sections where, on account of the brack either in soil or water, the peach root might not prove as suitable, and in such cases either the bitter or the peach almond makes an excellent substitute, and are but slightly affected by brack conditions. Seedlings of the hard-shelled almonds also make very suitable stocks. Plum stocks are not used for the almond, the trees being seldom planted on soils for which the plum is better suited than the peach or almond.

The propagation of the almond is almost entirely confined to the usual nursery practice of budding and the ordinary rules for handling nursery stocks should be observed. The almond makes a fine tree, and plenty of room should be allowed for it to develop properly. Planting at a distance of 25 feet apart gives none too much room, and if land is available and not too expensive it is well to allow a distance of 30 feet between the trees. This is perhaps most needful when they are worked on bitter almond stocks. Holes should be dug 2 feet wide by 2 feet deep, and all care taken in planting the trees.

The distribution of varieties throughout the orchard is of the greatest possible importance on account of the suitability of one sort for the pollination of its neighbours. South African statistics of a reliable nature with regard to pollinating varieties are not forthcoming at present, but Mr. R. H. Taylor, of the University of California (the professor of Pomology) states that Languedoc, Nonpareil, I.X.L. and Texas, and possibly some others, are inter-sterile, whilst Ne Plus Ultra and Drake's Seedling make thoroughly practical pollinators for Nonpareil, and I.X.L. may be pollinated by Drake's Seedling.

The best plan, therefore, is to plant the trees out in rows, setting out four rows of one sort and then four rows of a pollinating variety next to the first, and so on. Although the common hard-shelled variety has not much commercial value, it has been found useful for pollinating purposes, and a row of this variety planted round every almond orchard would be a good investment, quite apart from its assistance as a windbreak. The keeping of bees in an almond orchard often proves of the greatest assistance in the cross-pollination of varieties.

Yield.—As a rule, a few nuts may be found on the trees when they have completed their third year. At five years old 4 or 5 lb. of nuts per tree is not unusual; at ten years an acre of almonds should yield from 1200 to 1600 lb. of nuts, whilst a ton of nuts is well within the bounds when dealing with trees eighteen years of age or over.

Pruning.—It has been generally accepted that the almond does best when it receives least attention from the knife of the pruner. It is, however, quite necessary to shape the tree with some reference to the loads of nuts which it will have to carry in the future. With this object in view it is well to start the tree in much the same way as a peach is started, allowing three strong-growing branches to remain at the end of the first season's growth and cutting these back about half way in June. It may be wise to continue similar treatment the following year, allowing six branches to remain, but after that the custom has been to allow the tree to grow very much as it likes, and not cut back any branches at all after the second year. Should the limbs become too numerous and the inside of the tree too crowded they must be removed by cutting the superfluous ones off entirely, as close as possible up to the starting point whence they proceed and painting the wounds over.

The almond, like other trees, has different habits of growth. Some kinds have quite a willowy habit, like Nonpareil, whilst others, like I.X.L., have no tendency in that direction, but naturally assume an upright form. It is apparently inherent in human nature to endeavour to form trees in accordance with certain set ideas, and hence they are made to assume unnatural and artificial shapes. As a consequence the upright trees in the hands of the pruner are made to become more spreading, whilst those which naturally spread and have a willowy growth are forced as far as Nature will allow to take on an upright shape.

Wickson, in his "California Fruits," quotes Leonard Coates, of Morgan Hill, as having reached the conclusion that the almond should be pruned like a peach, not only started like a peach, but annually pruned after it comes into bearing for the production of new wood and thinning out the excess of such shoots to prevent the tree from becoming too bushy. When this is done, he has found for a number of years that trees thus pruned bring regular

and heavy crops, whilst adjacent and unpruned trees have a scanty set of nuts. Pruning the almond in this manner has not been attempted, at least to any extent, in South Africa, but the system may be worth experimenting with.

Ordinary cultivation methods as applied to deciduous fruits generally are also applicable to the almond.

Harvesting.—This is usually, but not always, a simple matter. Some kinds ripen and drop their nuts to the ground; these should be picked up every other day or so. Other sorts, especially in humid climates, seem loth to part with the fruit, and it has to be removed by shaking the branches and sometimes jarring them with long poles in order to cause the nuts to fall. It is customary to place large sheets of coarse brown calico or canvas in order to receive them. In dry, clear atmospheres the nuts fall readily and are of a good colour, requiring no bleaching. In a humid climate, it is often found that the almond is more difficult to dislodge from the tree and when finally gathered the nuts are dull and discoloured. For sale purposes, it is necessary that the appearance of such should be improved, and after being dried on trays by exposure to the sun, they are bleached by sulphur fumes just as dried peaches and apricots are. Whilst the sulphuring process improves the appearance of the nuts, it certainly does not improve the flavour of the kernel and also militates against germination, should an attempt be made to plant the nuts for nursery purposes.

Varieties Grown in South Africa : Brande's Jordan.—A strong-growing variety with characteristics similar to the Jordan, bearing nuts of similar type. Soft shell.

Burbank's Seedling.—Originated in California by Luther Burbank. Late bloomer. Tree very hardy and heavy bearer. Soft shell.

Cornichon.—Carter and Co., of Maritzburg, describe this as being the finest Spanish almond, with long-shaped nut, thin shelled, tree a good and heavy bearer.

Drake's Seedling.—This is a variety originated in California and one of the most popular there. The tree is a strong and vigorous grower and reported to be a good bearer, yielding regular crops. It is a late bloomer and may thus escape early frosts in localities where they occur only occasionally. The nuts are of medium size, short and plump with many double kernels. Should be planted with Nonpareil and I.X.L.

I.X.L.—A favourite variety here. The tree is a strong and upright grower, a native of California, hardy and vigorous. Bears a nice-shaped almond, neither too short nor too long. Shell perfect in appearance and extra soft. Kernels nearly always single. Weight of kernels 9 oz. to the pound of nuts.

Jordan.—This is the best almond in cultivation, but not largely grown in South Africa at present; its bearing qualities here are

therefore not a matter of certainty. The nut is long in shape—the longest of all almonds—full bodied and of excellent flavour. It sells at a higher price than any other variety. Soft shell.

Ne Plus Ultra.—This is a seedling variety from California, where it was originated. The tree is a vigorous grower, having large leaves and bearing nuts which are nearer Jordan in appearance than most others. Kernels are always single and go 10 oz. to the lb. of nuts. Paper shell.

Nonpareil.—Another Californian variety originated by Mr. Hatch of Suisun, who has introduced many new varieties of almonds The tree is of a willowy growth, and has been known in Sout Africa for a good many years. The nuts are paper shell, alway containing single kernels. It should be a popular variety o account of the proportion of kernels to the pound of nuts. Kernes 12 oz., shells 4 oz. Plant near Ne Plus Ultra and I.X.L.

Princess.—An Italian variety with a good reputation, but not widely planted in South Africa. Tree is fairly vigorous, bearing nuts of medium size but somewhat short. Kernels flat and rather wrinkled. Paper shell. Kernels go 10 oz. with shells 6 oz. to the lb.

Texas Prolific.—Originated in the State in America whose nam it bears, taken to California and introduced thence to South Africa It is a popular variety and the name indicates its bearing possibilitie The tree is a very hardy, strong, upright grower and late bloome The nuts have a shell which is almost white, containing a rath r small but plump and sweet kernel. Soft shell.

Hard Shell.—The common variety at the Cape, bearing useful crops of nuts of rather small size and having small kernels. Not a particularly profitable sort, but useful as a polleniser of other kinds. Good to plant round an orchard.

The Peach Almond.—This is mentioned because it has already been referred to as being useful as a stock which is largely resistant to brack. Very few trees of this type are to be found in South Africa or indeed anywhere. Occasionally one may be seen in some old orchard at the Cape. The largest number in one orchard belong to Mr. R. Rubidge, of Wellwood, Graaf Reinet, C.P. The fruit, if it can be termed a "fruit," resembles both the almond and the peach. The nut or pit contains a kernel which is sweet and is used sometimes by confectioners. It is more like an almond than the pit of a peach. The fleshy part is far too thick for the hull of an almond, and also much too thin for the peach. The leaves and branches resemble the almond more than the peach. Used principally as a stock for other varieties and also fruits.

The Britz Almond.—This South African variety was found as a chance seedling by Mr. Nel, of Montagu, C.P., on the farm of Mr. Britz at Riverdale. Mr. Britz, who was then seventy years of age, stated that he remembered the tree, as a boy, bearing heavy

crops of nuts. Mr. Nel has since propagated many thousands of the Britz Almond and has an orchard of them himself. They are regular and heavy bearers with him, of nice quality, soft shelled nuts. The tree is a vigorous grower of slightly spreading habit. Mr. Nel says " Paper shell " makes a good polleniser. It is possible that the blossoms are self-fertile. Can be strongly recommended.

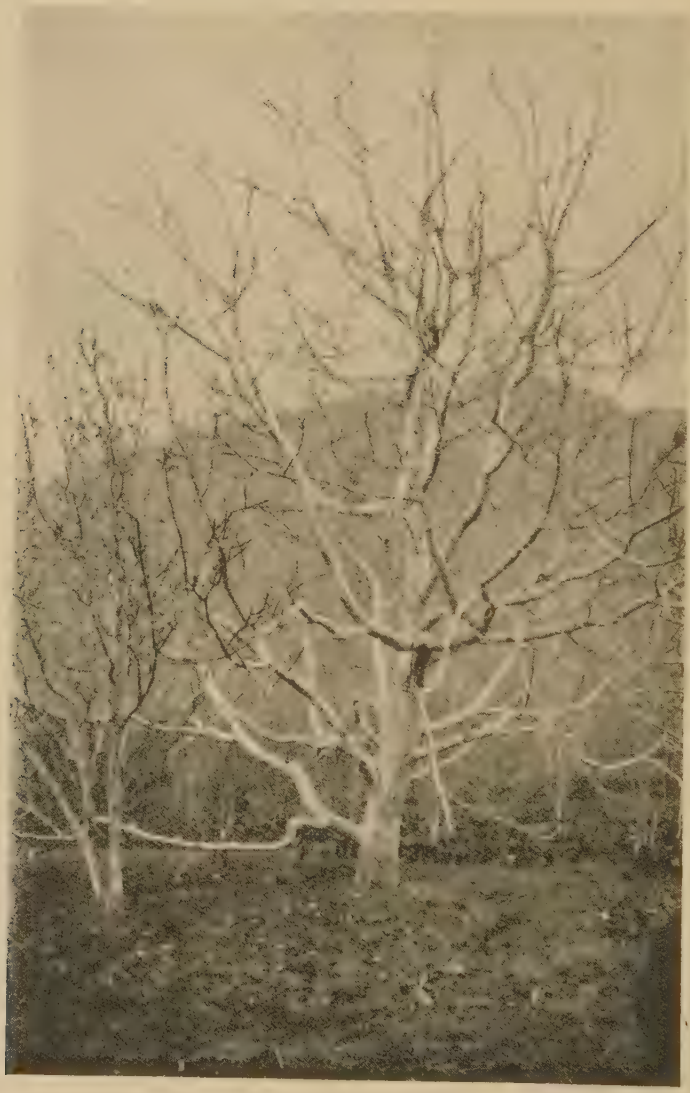
The Walnut

The walnut of commerce—the so-called " English Walnut " is a native of Persia, whence it has spread to most other countries. The distribution was largely effected by English traders and that is how the word " English " became attached to it. Apart from that, the walnut, as it is grown in England, makes a magnificent tree and doubtless this impressed oversea visitors and added kudos to the walnut as grown there.

In olden times the walnut was likened to a man's head; the outer woody covering being compared with the skull and the folds of the cotyledons to the convolutions of the brain and was supposed to be especially efficacious in brain disease (Sir J. Lubbock on " Seedlings ").

The English walnut was the first to appeal to the commercial instincts of the fruit growers of California and was extensively propagated, chiefly by the planting of seedlings. With the advance in the interest taken in the fruit, it was not long before it was discovered that very considerable difference existed between the various seedlings. The yield from some trees was so much better in quality than that of others and so the question of selection was taken up. Those with thin shells gradually became favourites and when one particular type called " The Santa Barbara Soft Shell " was introduced, it at once became the most popular of walnut varieties and is still a favourite.

As time went on other varieties were introduced from France—trees which did not attain the size of the English types, but bore crops at an earlier date and it was said were more regular croppers. At present, the California walnut business is an extremely large one. It is handled by the California Walnut Growers' Association—a strong co-operative body and the output of walnuts calls for the employment of hundreds of railway cars annually in order to deal with the product. The same types of walnuts exist in South Africa as those already referred to. We have the Old English Seedlings and they preponderate to a very large extent. Most of our propagation is done from seeds and not much interest has been displayed in the growth of this very lucrative crop. The oldest walnut trees are in the Cape Province and the district round Oudtshoorn has probably more than any other. To Mr. H. E. V. Pickstone, the



WALNUT TREE AT HEX RIVER, CAPE PROVINCE.

pioneer fruit grower and nurseryman, belongs the distinction of the first planting of walnuts on a really commercial scale. Some thousands of trees were set out on his farm "Platkop" in the Clocolan district in the Orange Free State.

Colonel Sir Walter Hamilton Fowle also planted many hundreds of trees at Rosehaugh, in the Lydenburg district of the Transvaal. There are also smaller plantings in other areas. Insufficient interest is taken in the planting of this tree. During the past few years our imports of walnuts from oversea have been as under and we could have grown them as well, or better, ourselves.

In 1920 the quantity was	11,827	lb., valued at	£828
1921	„	„	37,879	„	„	1587
1922	„	„	158,122	„	„	4717
1923	„	„	93,632	„	„	2949

The demand is not confined to the actual eating of the nuts for dessert or other purposes, but there is a constantly increasing one for confectionery and sweets.

In addition to the English walnut, we have in South Africa the American Black walnut and other hybrids between that type and the English nut; also the Japanese—all of which it will be necessary to mention later. It may be said that as bearers of first-class edible nuts, none of these types are to be considered.

Soils.—As a rule, it will be found that the better the soil the better the tree will be. Amongst the most suitable we have in South Africa are the deep silts and loams to be found in or about the Karroo. Oudtshoorn has the best and largest walnut trees in the country and the soil they are planted in answers to the above description. It has been said that the walnut will thrive in any kind of soil. In 1911 the author saw planted in an old river bed in California some hundreds of walnuts, but the limit had been reached in that instance, for not only had the trees not put on much growth, but at the age of about five years they were beginning to die.

Almost any soil of good depth which is of fairly good quality and well drained, apart from the black soils which we call "turf" and the Californians "adobe," may be regarded as acceptable to the walnut. The red bush-veld soils of the Transvaal have produced well-grown trees and fruit of excellent quality at the Experimental Station at Warm Baths, where numbers of trees were planted for variety testing purposes. At Potchefstroom Experimental Station, situated in a district well suited to the growth of the tree under the ordinary soil conditions existing there, the presence of an impermeable ironstone gravel a few feet from the surface of the ground rendered the growth of this tree a matter of difficulty and as a consequence the walnuts planted in 1904 were uprooted after striving hard against bad conditions for some sixteen years.

Climate.—The walnut tree has an extremely wide range of climates within which it will flourish. As has been stated, the tree in England attains magnificent proportions and endures a climate which is frequently not many degrees above zero. At Oudtshoorn, and in other localities at the Cape where the tree thrives, very high temperatures are occasionally recorded. Quite recently the thermometer showed one of 120° Fahr. at the place named. No severe frosts are recorded there.

On the Free State high veld, the cold in winter is intense though the thermometer does not fall as low as in England. At the Experimental Station at Warm Baths, temperatures of 112° Fahr. have lasted for three weeks on end and yet in each of these areas with such difference of climate the walnut flourishes exceedingly. There can therefore be no lack of land suitable for walnut culture from a climatic point. The tree is nearly as successful inland as it is at the coast within the more humid belt. The Griqualand East district has always appealed to the author as likely to be one of the best in the country.

Irrigation.—Whilst the walnut can be grown where the rainfall is but moderate, say 27 inches or so, without irrigation, even within that area the tree will respond to water and this is more especially the case in the warmer parts of the country. It has been stated that a walnut tree requires as much water as an orange tree, but this is not borne out by results, at any rate in South Africa. Provided a walnut tree gets up to 35 inches of water annually, either in the shape of rainfall or by other means, that should suffice for all ordinary conditions.

The method and time of application should be well considered. As the trees when young stand some distance apart and their roots do not extend far from the trunk for the first few years, the furrow method of irrigation is all that is needed and as the tree does not suffer, as does the orange, from collar root, the water may be, for the first couple of years, run round the stem of the tree in a basin; as it grows larger and its roots extend so that they eventually fill the whole of the ground between the trees either the check or the flooding system of irrigation should be adopted in order that moisture may be the more readily available for the feeding roots.

As regards the periods at which irrigation water should be applied, a good deal depends on the rainfall—whether it comes early or not. Most of the walnut trees in South Africa are grown within the area of summer rainfall and should the rains be late in coming, then water may be given possibly as early as September. It is not likely that more than two more waterings will be needed prior to the last of all—which should be given a couple of weeks before the crop begins to ripen; this application should be made as soon as the cracking of the first shell is noticed. The result of this

irrigation is that the crop will be the more readily gathered as this last watering has the effect of making the hulls crack open and the walnuts or a large number of them drop out—thus rendering the gathering of the crop a fairly easy and rapid task.

Propagation.—Almost if not quite all of our older plantings are comprised of seedlings. Very many of these have produced and are still producing an excellent nut and it is in these that what little business has been done in home grown walnuts has been conducted. Probably amongst them are some with extra thin shells and of better quality generally than others; there may also be some specially good bearing strains, but if so, little has been done in the way of selection and distribution of these better types.

Introductions of varieties from France and America have taken place also, but with very few exceptions the practice has been and still is to raise walnut trees from seed.

This is entirely the reverse method to that employed in California, where the varieties best suited to different districts have been studied and propagated in accordance with the demand. Some are suited for warm and others for colder climates—much depending on the stocks on which they are worked and the trees distributed accordingly.

The Horticultural Division of the Transvaal Department of Agriculture imported a number of varieties from America for test purposes. They were planted at the Experimental Station at Warm Baths, 60 miles north of Pretoria, in about 1908. The best nut of the lot was one called " Placentia Perfection." It produced heavy crops of best quality fruit, medium to large in size with a shell which could be cracked in the fingers. With the abandonment of the Station by the Department in 1918 it would seem that interest in the variety had been lost. The fault, if fault there be, is not that of the Division, as it has had an entirely insufficient staff to carry on ordinary routine work quite apart from taking interest in anything of a special nature, no matter how much it might benefit the country at large.

Cuttings of this particular variety had, however, been supplied to Sir Walter Hamilton Fowle and he successfully worked them on to a Japanese walnut as well as others. The grafting of the Placentia Perfection on the Jap was an outstanding success; an extremely rapid growth was put on and good crops followed within four years. As far as the author is aware, this is the only instance of the Japanese type having been used as a stock in South Africa.

With the necessity to produce the best and most profitable varieties, the budding and grafting of the walnut *must* be considered. Unless this is done, and no great difficulties present themselves, the development of the walnut industry must lag behind. It is so easy to plant a few nuts and trust to Providence to give extra

specially good trees as a result, but unfortunately, or perhaps fortunately, Providence does not attend to such matters.

Just as long as seedlings are depended on, so long will our product be irregular and variable. A purchaser of nuts from a sample of soft-shelled ones wants the goods up to sample and that from seedling trees cannot be relied on and consequently recourse must be had to other methods of propagating a more reliable article.

The question of stocks is of the greatest importance. No extended South African experience exists and as a consequence no definite recommendations can be made. The use of the Japanese nut (*Juglans Sieboldiana*) already referred to would appear to indicate the use of that type for stocks. The instance is, however, an isolated one, and although the use of that particular type is worth further experimental work, it is not safe to make any definite pronouncement with regard to its adoption as a stock for the English walnut at present.

The American Black walnut is used in California as a stock for the English type of nut, but there are others, partly of Californian origin, which, with different hybrids, are fairly generally in use as stocks, and amongst these are Royal and Paradox—both of which were introduced into South Africa some years ago.

Just now the simplest and most common-sense method of producing young walnut trees of a reliable nature is to use seedlings of the ordinary English walnut, selecting vigorous healthy trees from which to take the seed and again selecting the healthiest and strongest growing stocks for grafting purposes and scrapping the balance.

Extended trial with the Japanese walnut as a stock may demonstrate its suitability, though it is not likely that English walnuts worked on it would attain the size they would when grown on seedlings of the English type.

Budding.—Budding is, as a rule, only practised on nursery stocks and may be done at the fall or in the spring of the year. As a rule, the latter is more successful. Budwood should be dormant and it is necessary therefore to cut it during the months of either July or perhaps August in the colder districts. It should be kept in cold storage at about 38° Fahr., or each cutting may be wrapped separately in sacking and buried in some cool and moist but not too moist earth until it is required for use in September or October. Buds should be taken from matured round wood and from the lower branches of the tree if possible; such bud wood is more likely to be fully matured than that from the top branches.

The actual process of budding the walnut is very much the same as that in budding any other trees. Spring budding finds the stocks full of sap and the bark slips easily. The size of the buds inserted should be larger than in most other instances: a bud of an inch or slightly longer is not too large.

The stocks may vary from $\frac{3}{4}$ to $1\frac{1}{4}$ inches in diameter at the budding point. The usual T-shaped incision is made, the bud inserted and wrapped fairly firmly with raffia. As a rule there is not much difficulty in budding the walnut, providing the necessary care is taken.

Grafting.—Grafting is also practised amongst nurserymen. The stocks are cut off low down to within a few inches of the ground level, sometimes at the exact level, as the operator may be most accustomed to, and the scions whip grafted on. Raffia is used for tying the grafts in. The tops of the scions are waxed carefully and the soil on both sides of the rows of grafted stocks is heaped up to about $\frac{1}{2}$ inch above the top of the scion. As the buds start to grow and push through the soil, stakes should be set to which the young trees must be tied when about 10 or 12 inches high. They are kept tied to the stake and compelled to make a perfectly straight growth until fit for planting. The date at which the trees may be fit is very uncertain—some walnut trees make a slow growth. In a few districts, indeed, so slowly do they grow that it seems not worth while to attempt a walnut nursery, whilst in others no difficulty is experienced in getting a fairly quick growth on the trees. A walnut tree may be fit to plant out after it has been budded for no longer than twelve months; in other cases, trees are better left until they get big enough and this may take two or even three years.

The use of the bark graft is generally a success and formerly the system of annular budding was in vogue, but has been largely discarded.

Working over old trees or those which may have proved unproductive may be done either by budding or grafting. The author prefers the latter method. If budding is done, the large branches are cut off at a distance of about 2 to 3 feet from the forks of the tree, depending on the size of it; a large tree with branches of 6 or 8 inches in diameter may have longer stubs left than a smaller one of 2 to 4 inches. This may be done in June or July. When the new growths have started and are about a couple of feet in length, the buds can be put in a few inches above the old stub. It is as well to leave plenty of small branches; later on it will probably be found desirable to cut off some of those which are budded; the idea of budding more than may be needed is to spread the sap flow over as great an area as possible and so prevent " drowning out " of the buds by too much sap.

In preparing the tree for working over by grafting the same method of cutting away the large branches is adopted and it may be said here that, whichever method is used, the large stubs must be painted over with hot grafting wax and what is left of the tree should be whitewashed as a protection against sun-scald. Wickson

in his "California Fruits," page 440, says, quoting Mr. Neff—a walnut grower of Anaheim, California:—

"If the trees are from 3 to 5 inches in diameter they may be cut off 4 feet above the ground and below the branches four or five scions may be placed in one stock, or three or four of the branches may be cut back to within 10 to 24 inches of the trunk and two or three scions placed in each. All the other branches should be removed from the trunk.

"Old trees of from twelve to twenty years should have the branches cut at places where they are from 3 to 6 inches in diameter and from 5 to 8 stubs left which will be from 3 to 6 feet in length and should have as many as six scions in large stubs: the other branches being removed before the scions are put in place. In sawing branches it is necessary to make two cuts, the first being some distance above or outside the final cut to prevent splitting the stub or the trunk when severed part falls. The scion should always be of solid matured wood, that is, with as small pith as can be had readily and must have good, living buds. Each scion should be about $\frac{1}{4}$ inch in diameter and have at least two buds. The growth having buds close together is best as shorter scions can be used.

"To receive the scions use a heavy butcher's knife and mallet to split the stubs, placing the knife across the stub to one side of the pith as if a chip of $\frac{1}{2}$ to $\frac{5}{8}$ of an inch were to be taken off. Then depress the handle of the knife to an angle of 30 to 40° and split the edge down from $2\frac{1}{2}$ to 3 inches, allowing the knife to reach the further side of the stub, but not making the split entirely across the stub. Open the cleft with an iron wedge $\frac{1}{2}$ to $\frac{5}{8}$ inch wide and thickest on one edge, placing the thickest edge towards the outside.

"Trim the cleft in the stub with a sharp knife so it will be smooth. Then cut the scion so as to fit perfectly and place it so the inner bark, 'the cambium layer,' of both will be on the same line, or at least will cross twice: then remove the wedge and put hot wax all over the cuts on both stock and scion at once. The scions should frequently be examined and any excessive flow of sap wiped off, and the stub re-covered with wax as soon as dry. Excessive flow of sap for several weeks will cause the loss of the scions, as the callus will not form in water. This may be controlled by boring $\frac{1}{4}$ inch holes in the body of the tree near the ground. Three or four holes 4 inches deep will be sufficient to control the flow of the largest trees. No damage is done to the body of the tree as the holes soon grow over."

The author has found the ordinary cleft grafting described in the chapter on grafting to be just as successful as any other method.

Bark grafting is equally good. In all such grafting above ground, with the walnut, the application of grafting wax is imperative and the work should be done immediately after the scions are inserted—the tops of the scions must not be forgotten.

Planting.—Walnut trees for planting in orchard form should be strong and well grown; unless such are to be obtained, it will pay to let them stay in the nursery for a time.

Trees of 4 feet in height or over should be planted and none smaller if by any means it can be avoided. It is not usual to see them much larger than that in South Africa. Such trees may be planted out in the orchard immediately on arrival from the nursery in their original form, without any cutting back; they are more likely to start growth quickly when they are not cut. The walnut, like all soft pithed trees, is better when left alone as far as pruning is concerned and only what is absolutely necessary should be done.

If trees 6 or 7 feet high are to be had such may be cut back at planting in the usual way to about 4 feet from the ground. The future cultivation of the walnut orchard demands that plenty of space be left for implements to get as close to the trees as possible and if the trees are headed too low, this cannot be done.

English walnuts should never be planted less than 40 feet apart—there are instances in South Africa of trees being planted at 25 feet with the result that the branches interlace; the roots not only do that also, but exhaust the soil; the crops are both small in quantity and the nuts in size. Indeed it is a question if it is not wiser to plant the trees at 50 feet apart when the soil is good and deep as eventually the trees may require it.

French and also Japanese varieties do not need as much room, as the trees do not grow to be as big as the English sorts; in some instances, 30 feet is quite far enough apart for these.

Occasionally the practice of planting a nut in the place where it is intended to grow may be seen. The idea is that planting in this manner allows the development of the original tap root, which is, of course, cut off when the trees are removed in the first instance from the seed-bed, and again from the nursery row. The possession of a tap root when the soil is deep is certainly an advantage and the practice of *in situ* planting has something to be said for it.

Catch Crops.—There is so much land idle between the trees when planted at 40 feet apart that it is just as well to make use of it for a couple of years at least. As the tree thrives in so many different districts, the choice of what the inter-crop shall be depends largely on what the soil and climate are suitable for. The question of planting a fifth tree in the centre of each square of four may be worth considering. Walnut trees will bear, depending on the variety, when from four to seven years old, but the crops from such trees would not be very large ones and centre trees might safely be

allowed to remain until the walnuts were ten to twelve years of age. Quick-bearing trees such as plums and peaches may be planted, also apricots and nectarines; much depends on the locality. Vegetable crops are also in order, such as green peas, beans, tomatoes, melons and pumpkins, whilst a few rows of mealies—if not allowed to come too near the trees, not nearer than 4 feet—might also be planted without injury to them. Ground nuts would also afford some return from the soil and not do very much harm to it.

Pruning.—The less pruning the walnut gets the better. Left to itself, it generally assumes a good shape, provided the stem is not cut too short originally. This does not mean that the tree should *never* be touched with a pruning knife, for there are occasions—such as after a frost—when the tender branches die from the tips downwards and may keep on dying back unless cut off well below the dead portion. The same may happen from sunscald. When branches cross and interfere with each other, the offending one should be cut clean off right up to the stem and the wound painted over. Should too many branches have been allowed to grow and the centre of the tree become crowded, to the exclusion of light and air, then the pruning saw may be brought into action and the entire removal of a few branches may make all the difference to both the growth of the tree and the yield and size of the fruit.

Cultivation.—Cultivation should be clean as in the case of most orchard trees. Weeds should be all turned under prior to the gathering of the crop and the ground reduced to as fine a tilth as possible so that fallen nuts may easily be seen and picked up. When nuts are inclined to become small, a good dressing of ordinary stable manure may be applied and old trees are much benefited by the addition of ground bone to the land, before the rainy season comes along, at the rate of 500 lb. to the acre.

Gathering the Crop. -Who has not heard the old saw? " A woman, a dog and a walnut tree—The more you beat 'em the better they be." Amongst the early experiences of many country-bred lads in England the beating of the walnut trees during the few days of the Michaelmas holidays will be remembered—in order to get the nuts off. When gathered the price was about 1*s.* per 100 of 120—never less. Present-day practice may mean that a crop is handled either by allowing the nuts to fall to the ground, picking them up every few days, or by waiting until, from the appearance of the hulls, the bulk of the crop is ready and then by the use of " the stick " in the shape of long poles tapping the sides of the branches so as to give sufficient vibration to dislodge the nuts; the bulk of the crop may thus be got in at one operation though there will still remain a few droppers.

The nuts may be hulled in the orchard: placed on trays in the sun to cure or dry (fruit-drying trays will do) and allowed to remain

a few days, shaking them up daily and putting them out of the sun if it is too hot. Then they should be sorted for size, though it is not regularly done in South Africa—this is one of the things it pays to do; then they should be bleached by putting them in the sulphur house for half an hour: taken out and placed in boxes or sacks ready for sale and dispatch. It may be said the bleaching and curing do not improve the flavour of the nuts, but they certainly do the appearance. They bleach better if a little damp and this may be secured by dipping them for a moment in water when nearly dry and sulphuring them.

Enemies of the Walnut.—Within the last few years the codling moth —that pest of the apple grower—has turned its attention to the walnut and if the orchard should be in a district where codling moth is present, the same system of regular spraying is demanded if a crop is to be secured. The banding of the tree stem with sacking and the regular examination thereof and the destruction of the grubs caught must also be attended to.

Walnut Blight.—This is the worst enemy the walnut has. Fortunately it is but little known in South Africa. The disease affects the appearance of both the fruit and leaves. First symptoms are the appearance of smallish black blotches on the skin of the hulls, somewhat sunken beneath the level of the skin; gradually these extend so that they may almost cover the whole of the hull. The nuts remain smaller than usual and never attain full size; the leaves get a twisted look and the whole tree languishes. The fruit is unsaleable, as the blight passes through the hulls on to the shells of the nuts and the kernels do not mature properly. The application of Bordeaux mixture regularly every three weeks is about the best thing one can do to fight the disease, commencing just before catkins appear on the trees in spring and continuing until the nuts are ripe, and this treatment is by no means entirely satisfactory.

Walnut Varieties.—In addition to the English walnut seedlings, which are generally propagated by our nurserymen, a very large nut called the " Barrydale " is propagated in the Cape Province and can be highly recommended. The following French and other varieties have been introduced.

Praeparturien.—A variety which comes into bearing at a much earlier age than the English one. The trees have been known to bear fruit whilst still in the nursery rows and at four years old a small crop has been obtained. The nuts are of medium size and good quality.

Franquette.—A larger and longer-shaped nut than the last mentioned, but does not bear as soon. A good cropper, but like all the French varieties does not make as fine a tree as the English type.

Mayette.—This is a roundish nut; large and is often preferred on account of its soft shell and fullness of kernel.

In addition, Placentia Perfection already alluded to. This nut is one of the best if not *the* best variety at present grown in South Africa. It is of medium size with shell sufficiently thin to crack between the fingers. The kernel is fully developed and of choice flavour. A good regular bearer and the tree is a vigorous grower. It has done well on Japanese walnut stocks.

Japanese Walnut (*Juglans Sieboldiana*) is propagated and distributed principally in Natal. It is a quick grower but does not make a big tree. It is of spreading habit and bears fruit in bunches; is of little real use as a commercial nut, though the tree is ornamental.

American Walnut (*Juglans nigra*) commonly called the American Black walnut has been introduced and grown by the Forestry Department. The tree is a handsome one and the timber is valuable. As an ornamental tree it makes quite a feature, but the nuts are of little or no value for commercial purposes. Selection and hybridisation may, in time, produce something more in keeping with our ideas of what an edible nut ought to be like.

Royal and Paradox were both introduced by the Agricultural Department about 1908; the trees were both quick and sturdy growers and may prove useful as stocks on which to work English varieties. They are crosses between the English type and some strain of American Black walnut. The trees make fine looking specimens.

Walnut growing has not received the attention it deserves in South Africa. The following remarks by C. A. Reed are taken from the " Standard Cyclopedia of Horticulture " (L. H. Bailey) :—

> " If one quarter of the American Farmers were to plant even *two* walnut trees about their premises it is difficult to estimate what would be the aggregate increased value to such farms by the end of a quarter century—but certainly it would be very appreciable."

The Pecan

The Pecan is indigenous to the Southern States of North America, where the tree is now cultivated on a large scale for the sake of its nuts.

These bear some resemblance to walnuts, but are longer, and smaller in circumference; the shell is much thinner than the usual run of walnuts and many varieties of the nut crack quite easily in the fingers. The kernels have the same convolutions and are considered by some to be of better flavour than any walnut. This is a matter of taste.

The pecan, when grown under the right conditions, makes a very large tree. In its native habitat, specimens are to be found up to 6 feet in diameter, 6 feet from the ground. Bailey, in his " Cyclopedia of Horticulture," mentions a tree in Oklahoma, U.S.A., with a girth of 23 feet 9 inches three feet from the ground with an estimated

height of 180 feet. Trees like these are in a state of nature, seedlings growing in the most suitable surroundings.

The pecan was introduced into Natal at the end of the last century by the late Mr. Wilkinson, a nurseryman of Maritzburg, and a couple of fine old trees are still standing there. Since then a number of importations have been made.

They were introduced to the Cedara Experimental Farm on three occasions, the earliest date being unrecorded but approximately about 1905; these trees were planted in sod and consequently, being also on unsuitable land, they have not done at all well.

The second lot arrived about 1907 and Mr. G. Terry, the horticulturist there, states that they are now some 30 feet high and cover 148 square yards of ground each.

The last importation to Cedara took place in 1913 and these trees, owing to not having arrived in good order, have not done too well. The varieties were " Schley," " Van Dieman," " Delmos " and a seedling. Each of them is still represented by at least one tree, so that propagation from them is possible.

Both the Agricultural and Forestry Departments introduced the pecan into the Transvaal, but in neither instance was the result satisfactory, owing partly to bad conditions of the trees on arrival and errors in selection of situation. There is no doubt but that the pecan will succeed in many of the warm parts of South Africa. So far the Natal specimens are the best in the country and there is every indication that, in time, growths equal to those obtained elsewhere may be recorded.

The tree has recently been very extensively planted in the Southern States of North America. Its handsome appearance and profitable crops have captured the imagination of many farmers in those States and pecan growing, almost unknown in the last century, has become a large and flourishing industry. The Texas crop alone in 1909 is reported as being over $9\frac{1}{2}$ million lb., valued at almost 1,000,000 dollars.

It will be seen therefore that in U.S.A. the pecan nut must be largely in demand. Like the walnut, its fruit is not so much required for eating out of hand as a dessert, but for the use of the sweetmeat-maker and confectioner.

Insufficient data are available to state definitely exactly which of our soils should be most suitable for the growth of the tree. It may safely be said, however, that deep, well drained, yet fairly moist soils should be entirely suitable. Some of the deep alluvials of Swaziland and Northern Zululand should provide a good home for the pecan, if sufficient moisture is present. River banks and low-lying situations are quite suitable, provided there is no chance of the roots having to remain long in soil which is water-logged.

Propagation.—The pecan is propagated by the budding and

grafting of seedlings of some vigorous tree, or even preferably from some strong-growing wild one. The specimen tree mentioned at Maritzburg is a very fine one bearing heavy crops of nuts annually; it is an example of just what is wanted for propagating purposes. The nuts germinate readily if not allowed to dry out; they should be placed first of all in seed-boxes or beds and then transplanted when 6 or 8 inches high to nursery rows, which should be 5 feet apart and the trees at least 12 inches apart in the row. If preferred, the nuts may be planted out directly in the rows and should any fail to germinate the spaces can be filled up from the end of one of the rows.

It is also possible to plant the nut directly in the spot where the future tree is to stand, the object being to enable the tree to grow without being transplanted at all and thus save cutting the tap-roots; trees so grown are supposed to thrive better than others which have never been transplanted. Should this method be decided upon, the planter must be prepared to spend a good deal of time looking after his trees when the working over takes place, whether by budding or by grafting.

Methods mentioned as being suitable for working over the walnut are equally applicable to the pecan; there is no particular difficulty in either whip- or cleft-grafting the tree and it may be budded with ease by the use of the " chip-bud " (see chapter on budding and grafting).

The Chestnut

There are but few chestnut trees in South Africa and commercial plantations cannot be said to exist. The tree is an extremely handsome one, lofty and spreading in growth, and also, when the right variety is selected and properly looked after, a profitable one to grow.

It may be found almost anywhere within the Union and has, as may be supposed, a very wide range. It flourishes in England in a fairly cold climate and is equally at home in the hottest parts of Spain and Italy, where chestnut growing is an industry of importance.

Very fine trees are to be seen in the neighbourhood of Johannesburg and other parts of the high veld. As a rule, the tree is planted as more of an ornamental one than anything else and as far as the nut-bearing qualities are concerned these do not seem to have received anything like the attention they deserve.

Two principal types of chestnuts are to be found in South Africa, the European and the Japanese. The latter is of comparatively recent introduction, but the European type has been present in the country for many years. It is represented by named varieties from England and France, but Spanish and Italian varieties are merely termed " Spanish chestnuts."

As a rule, propagation is by means of seed. A consequence of

this is that with little attention being paid to selection, and an almost entire absence of budded trees, one may find quite a number which will bear large crops of burrs annually which are empty, instead of being full of nuts. Trees of this description may be cut down and grafted, no matter how big they may be and turned into profitable trees by the selection of scions from some good bearing strains. Continued planting of Seedling chestnuts has possibly been indulged in with more thought to the future shade than the bearing qualities of the trees and thus the value of a crop of nuts has been overlooked. When grown from seed the chestnut will yield its first crop after some six or seven years. The Japanese type is said to bear in three or four years.

It is unlikely that attention will be much attracted to the growth of the chestnut as an orchard tree, but it is just as easy to plant and grow a remunerative tree as one which pays nothing, and so it may fall out that the chestnut will be planted for the sake of its fruit as well as for its shade-affording properties. This can only occur after a good deal of work has been done in the selection of the right varieties and after the attention of our nurserymen has been focussed on the subject. Very few indeed of them go as far as to quote a single variety of chestnut in their annual price lists. Messrs. Carter and Co., of Maritzburg, have given more thought to this tree than most other firms.

No difficulty exists in the propagation of first-class and proved varieties by the usual process of grafting. Seedlings may be planted and worked over in just the same way as any other kind of tree; there is no secret about it, grafting the chestnut is easy and simple. Probably the cleft graft is the best to use, but even that depends on the ability and choice of the operator, some are skilled in one method of work and others use a different form in order to attain the same end. Grafted trees bear in about four years.

The Japanese type of chestnut is somewhat different from the usual run of Spanish to which most of us are accustomed. The leaves are smaller and the nuts larger, though the tree is not so likely in South Africa to attain the size of the European type. It is a hardy tree and prolific bearer of rather inferior nuts. Chestnuts are not often seen on our markets, but the fruit shops have them on sale during the season, *i.e.*, March, April and May.

Varieties Grown in South Africa.—Common Spanish seedling. This is the type usually seen and which will grow almost anywhere in the Union.

Japanese Giant. Described by Carter and Co. as yielding a very large nut often weighing 2 ounces. A free bearer and handsome tree.

Marron de Lyon.—A leading variety of the European type, one of the best bearers of good quality nuts and a heavy cropper.

CHAPTER XXVI

THE BANANA

Bananas are principally grown on a commercial scale in Natal. They may be found throughout the warmer parts of South Africa and a species exists in a wild state in the northern portion of the Transvaal. Most probably this variety is an indigenous one. It has fruits which contain seeds in plenty, but scarcely any pulp; the seeds are in demand amongst the natives, who string them on wires and use them as anklets; the seeds, about the size of a broad bean, but rounder in shape, are not placed too closely together, but just so that they may produce a clicking sound when the wearers dance, a pastime indulged in on every possible occasion. "Pisang Kop" in the Northern Transvaal—Pisang is the Malay name for banana, and is used also in Afrikaans—was the home of many thousands of wild bananas and they are still to be found there and in that neighbourhood.

The banana of commerce is, however, a different species and is now grown on an immense scale in Central America, Jamaica, the Islands of the West Indies as well as the Islands of the Pacific and the Canaries.

The export business in bananas to England has attained enormous proportions. Development of this industry was due originally to the Governments of both Jamaica and England. Each granted an annual subsidy of £20,000 a year for ten years in order to encourage —on the one hand, the development of a large supply of cheap and healthful food and, on the other, the utilisation of much land lying waste and admirably suited to the culture of the banana. The steamship companies have, since the inception of the banana export in 1901, kept pace with developments; their steamers are fitted up specially for the business and the fruit may be purchased as cheaply on the streets of the large towns of England as it can be in Johannesburg or Cape Town.

Our banana business, as carried on in Natal, is very largely in the hands of Indians; as a rule they hire the land, which they work, and make a good deal of money out of a few acres. They do not mind working all day long in the hot sun as does the ordinary white man, and so the growing of bananas has become to be regarded as coolies' work.

The supply of bananas by Natal is hardly equal to the requirements of the whole of South Africa. It is true that the fruit is grown in other centres, on the south coast, Cape and Northern Transvaal, but their whole product is hardly worth mentioning. The development of a business in the export of bananas is worth considering. There are thousands of acres of suitable land and, unfortunately, some thousands of men unemployed. The banana is a profitable crop to grow and will remain so.

BANANAS SHOWING THE EFFECTS OF HIGH WINDS.

The plants or trees, as sometimes spoken of, are propagated by means of offsets or suckers which are formed at the roots of the parent plant. Seeds in edible varieties are almost unknown. As grown in Natal, young plants consisting of a small bulb, with leaves, the whole being a couple of feet or so in height, are set out at a distance of from 12 to 14 feet apart, in squares. They require good soil, manure and water. Given these, the plants should yield fruit within eighteen months from the time of being set out. Mr. Fawcett, late Director of the Public Gardens, Jamaica ("The Banana," Duckworth, London, 1913), says:—

> "The banana has no seed but is propagated by young plants which bud from the underground stem of 'bulb,' as it is called, of the older plant. This bud at first gets all the food from the parent bulb, but very soon forms leaves and roots of its own. When the young plant is six or eight months old, it is about 9 or 10 feet high and its own bulb is about 8 or 10 inches across. This is cut clean away from the parents and the roots are trimmed off. It may be planted as it is. This bulb soon shoots both from the centres and from eyes all round. If a bulb is cut vertically, the eyes or young buds can be traced, clearly showing that the bulb is a stem structure; it is of large size, to provide room for the food material which is necessary at first for the formation and growth of leaves and roots. The cut surface looks white and starchy and, in fact, the minute cells of the bulb contain grains of

starch just as a potato does, and if required it could be eaten like a potato or the starch could be extracted, as in cassava or potato. The stored stationary food (starch) changes into the mobile food (sugar) when the bulb absorbs warmth and moisture from the soil: then growth commences and the eyes begin to shoot; one shoot takes the lead, monopolises most of the food supplied by the bulb and this leading shoot is known henceforth as the plant; the others are its suckers."

Soils.—The banana requires a soil rich and of sufficient depth to allow full development of the roots; 5 feet and over is not too much to allow, and, in addition, the drainage must be good. Black soils containing lots of humus are good—probably none are better. In Natal, many a hillslope is covered with bananas growing in soils which are not too rich; these are mostly of a reddish-brown colour and may have a considerable admixture of clay in their composition. The deep silt soils of the Karroo afford excellent examples of what a banana soil should be like; unfortunately, water is frequently lacking there and the winters are often too cold.

Although a rich soil containing plenty of humus is the best, there are many instances of successful cultivation of the banana in soils which can only be classed as poor originally but which, by judicious and regular fertilising, have been made to yield good crops for many years. The fertilising of a banana plantation in some parts of South Africa is rather an interesting and certainly an amusing study. The author once found a large heap of rubbish, made up of old boots, rotting sacks, mortar rubble, pieces of brick, dried grass and litter, stacked up ready to apply to the banana patch. It was explained that the bricks, boots and mortar were to be placed at the bottom of some holes which were being dug for new plantings, whilst the remainder would be thrown round existing plants and dug in, when rotted, with manure from the stable. Primitive, but economical. Probably without any knowledge of the first principles of fertilising—the constituents most in demand were being supplied: nitrogen from the manure, etc., lime from the mortar.

Whilst rough-and-ready fertilising of this kind may still be practised, the banana really requires something more in the way of a complete fertiliser, and for this purpose, in addition to the home-made compost, one containing potash, phosphates and nitrogen should be applied when it is found that diminution in the quantity of the yield occurs or the appearance of the plants denote exhaustion of plant food. As a matter of fact, very little fertilising is done in South Africa in connection with the banana.

Planting and Irrigation.—The size of the holes to be made will

depend on the size of the bulbs to be planted; if small ones, then holes 18 × 18 inches will be large enough, with the soil in the bottom well broken up and pulverised. If large bulbs are to be planted, it is as well to be generous in the matter of the size of the hole; the after-growth of the plant will warrant this. Holes from 2 to 3 feet wide may be dug, the bulbs must be handled with care and should be set out just as soon as possible after removal from their original site. Planting in South Africa is nearly always undertaken with small bulbs, consequently large holes are not needed.

Planting may take place at any time. September is a good month and plants may be expected to bear fruit within eighteen months, often less. After bearing one year, the original plant dies and production is carried on by secondary "suckers." Thus it is necessary to reconstitute a banana patch every few years; frequently this is neglected and the result is the growth of an immense number of plants much too close together, loss of size of fruit and vitality of the plants. Planting may be done at different dates with the object of obtaining ripe fruit at specified times, such as, for instance, when prices are highest. The larger the bulb planted the earlier the crop should ripen.

After watering at planting a weekly irrigation should be given and this may be done in the same way as an orange tree is irrigated, that is, in a circular furrow round the plant, but at least a foot away from the stem for the first month or two, after that a furrow straight down beside the rows; later on, one on each side of the furrow and 3 feet from the stems.

Climates and Altitudes.—The whole of our coast line where the banana flourishes is frostless: naturally also the altitude is low, well under 200 feet. In the Northern Transvaal, bananas succeed at 3000 feet, but this is about the limit unless situations are chosen with much care. There are instances of successful cultivation up to 3500 feet, but they are extremely rare. The plant will not stand more than a couple of degrees of frost and is better in every way without any.

Situations exposed to much wind are objectionable as the leaves split to ribbons when subjected to high winds, yet although this is the case, the banana is used as a windbreak in the south-eastern portion of the Cape and proves fairly effective. For success as a fruit-producing proposition, however, the banana should always be planted in a sheltered situation.

Cultivation.—After planting, cultivation of the banana should be carried out in the most effective manner possible. It is often difficult to utilise implements in some of our plantations owing to steepness of hill slopes or other conditions. Hand-work must be

resorted to. In some plantations, where facilities for irrigation are but meagre, cultivation should be thoroughly done. Where possible, the plough and disc harrow should be used and cultivation of the land should take place one way or another about every three weeks. Weeds may be left for ploughing under, but in a banana patch this does not often occur when the plants are at all close together. When planted at 14 feet, as our best varieties should be, there is usually little trouble in keeping the plants free from weeds—still less, of course, when they stand 8 or 10 feet apart.

The total acreage under bananas in the Union is a little over 10,000 and Natal claims some 90% of these. In discussing the business of banana growing from the point of view of yield, prices and profits, the author was told recently at Lourenço Marquez by a coloured grower that he as a rule got some 300 bunches to the acre, which he sold for 1*s.* per bunch. The cost of production did not amount to more than 40*s.* per acre. This is not a high figure and does not represent any outlay on irrigation. By far the larger portion of the areas under bananas are not planted with the idea of being irrigated—indeed, most of the coastal plantations are able to get along without water other than that supplied by the rainfall, which is fairly high, and the atmospheric moisture by which they are surrounded.

Diseases.—The banana in South Africa is free from diseases, and there appears to be no reason why this happy state of affairs should not be maintained. Importations of plants should be strictly under supervision, so that the dreaded " Panama " disease may not find any entry here. This trouble, which is bacterial, has played havoc amongst banana plantations in Costa Rica, Jamaica and other parts of the West Indies, and is still the cause of much anxiety to growers there.

South African Banana Varieties : The Natal Banana is the one variety grown in South Africa which has much commercial value. It is of Chinese origin and is botanically *Musa Cavendishii ;* it is the most widely distributed of all bananas. The plant is the smallest of the family, being comparatively a dwarf and averaging 6 or 8 feet in height. Its diminutive size, as compared with other large-growing varieties, is much in its favour, as it is less liable to damage from high winds.

The fruit is borne, as is the case with all varieties, in bunches, which may carry as many as 250 fruits or more; bunches are made up of " hands " and " hands " of " fingers." The flavour of the Natal banana is unequalled when grown under perfect conditions.

Lady's Finger.—Unlike the Natal, this variety is a large upstanding plant, often at least double the height of the Natal. The fruit

is, however, shorter and very much smaller and is not as satisfactory from many points of view. The bunches instead of being firm and compact are straggling, the hands comparatively few and the fingers small but of very good flavour and with a very delicate skin. The fruit is not equal to the first-named. The cultivation of this variety is scarcely conducted on a commercial scale.

Ducasse's Hybrid.—Mr. Leon Ducasse, of Hillarys, Natal, originated this variety in 1909 by crossing Lady's Finger with the common banana. Mr. Ducasse says:

> " This is the hardiest banana grown in Natal. Plants often reach 20 to 25 feet in height. It bears at an altitude of 2700 feet. In Natal the fruit is, when full grown, from 6 to 7 inches long; colour bright light yellow, covered with white bloom; skin of the thinnest and very finest texture. Bunches often contain 275 fingers. A very good commercial variety."

Ducasse's Hybrid, No. 2, he describes as:

> " Tall and slender, with reddish foliage when the plants are young; bears bunches of from 200 to 250 fingers; size 3 to 4 inches long. Is very slightly acid, but of nice flavour. Parentage identical with last named."

Common Banana.—This is often called the " Plantain," on account of the different shape of the fruit from that of the Cavendish variety. It is *not* a plantain, however, but a true banana of another species. It is the variety which is most frequently found outside Natal and is not a rival of the Natal banana. It is common in the Eastern Province of the Cape and is the variety generally found in the Transvaal. The plant is a handsome one, standing up to 20 feet in height. The fruit is not nearly equal to that of the Natal, being three-cornered in shape and shorter—usually about 5 inches long. The skin rarely gets to be the same clear yellow colour as the Natal and the fruit itself is mealy and has not the flavour of the Natal variety. There is a little demand for it in some country districts where the better classes of bananas are unobtainable owing to lack of transport or other cause.

CHAPTER XXVII

THE PINEAPPLE

Pineapples are indigenous to South America. In the Union of South Africa they were first grown in Natal. The most extensive plantations in the country to-day are to be found in the Eastern Province of the Cape, near to the old town of Bathurst, where the African Canning and Packing Company have some 6000 acres under this fruit. In addition, there are many other growers in the neighbourhood and probably the total area would amount to 10,000 acres. Natal has probably 2000 and the Transvaal 200 acres.

The varieties grown are confined almost exclusively to the Queen and the Smooth Cayenne, the former being by far the more extensively planted of the two. Many other varieties have been tested, both in the Cape, Natal and Transvaal, with the result that the two sorts named have been found to be the most suitable for South African conditions.

The Queen is a small pine, weighing up to 2 lb. or a little over, but averaging nearer 1½ lb. apiece. In Natal, it is largely sold to supply local and inland markets and some thousands of boxes are exported annually. In the Eastern Province of the Cape, enormous quantities are sent to the insatiable maw of the Port Elizabeth Cannery from the Bathurst pineries and there is in addition an export business to the European market besides that which is disposed of locally.

The Smooth Cayenne is a far larger pine and weighs up to 8 or 10 lb. each in the case of extra fine specimens, and an average size would be about 5 lb. weight. It is not as easy to handle for export as the smaller variety, being heavy and full of juice, but the local demand is good and the canneries like them.

The first pineapples brought to the Eastern Province came from Natal.

The following notes were kindly supplied by Mr. Longley Staples, of Langholm:

> "Mr. Charles Purdon's family says: 'Father happened to be in Mr. Lindsey Green's shop one day, when Mr. Green gave him 30 or 40 pine crowns (top of the fruit). Father

brought them home and planted them in his garden but the cattle knocked them about so much that in an effort to preserve them he had them replanted on a hillside, where they matured. The first locally grown pineapple sold in Grahamstown realised 7*s.* 6*d.* Father thinks the plants were given him in 1865. These pines are the ones from which all the pines now grown in the district originated, that is, so far as the variety known as the Queen Pine is concerned.' "

Mr. W. E. Masters, writing to *The Journal*, Grahamstown, dated March 24, 1906, says:—

" The pineapple industry gave the first fillip to the district by creating an objective. It offered a reward for broader views and supplied the financial aid which clothed and educated the present generation. This successful industry originated with Mr. C. Purdon, of Thorndon Farm; he obtained 40 pineapple crowns from a hairdresser (Green by name) in Grahamstown, from which practically the whole of the five million plants now in the district originated. Messrs. I. R. Staples, Tom Palmer and Jonathan Bradfield have each well over 300,000 plants, whilst many others have over 100,000 and they are still being planted."

Note.—It does not seem to be known where these original pines came from, but if not from Natal, then they probably came from Ceylon. So far as the Smooth Leaf Cayenne is concerned, it is almost a certainty that they came from Ceylon either direct or by way of Natal.

Mr. Calude Fuller, the Natal entomologist for many years, says:

" There is supposed to be a wild pineapple in Zululand but I have never seen it. I have seen some very fine bananas grown at Lake St. Lucia and Sibayi and there are a few pineapples grown too by the natives thereabouts. But whether these fruits come down the coast or up from Natal, I cannot say. You see the Tongas may have had both from the Portuguese. However, that is unlikely, as although Leslie mentions the Tongas as growing rice, etc., in 1871, he does not mention any fruits. There is no Zulu name for either pineapple or banana, so both are European introductions. At any rate, their history must go back to before 1860, as it was in that way coolies were introduced to start the sugar industry. Natal was already 30 years old and many tropical and sub-tropical plants had been introduced and established."

So well has the fruit succeeded there that Eastern Province growers claim superiority over the Natal product both with regard to size, appearance and flavour.

The history of the pine in the Eastern Province shows that it is not free from vicissitudes. After the early introduction, many farmers put in pine plantations hoping to reap a golden harvest. At that time there were no facilities for export, local transport was difficult and railways non-existent. The only local market, Grahamstown, was soon flooded and pineapples at a penny per

ONE-YEAR-OLD "QUEEN" PINES ON THE PLANTATIONS OF THE AFRICAN CANNING AND PACKING CO., LANGHOLM, CAPE PROVINCE.

dozen were to be had in plenty. As a result, most of the pine-apple fields were dug up and planted with other crops. After Union was declared in 1910, pineapple export began to look up, principally from Natal. Later, canneries started, huge areas were set out and the pineapple once more became a recognised crop.

Districts, Situations and Soils.—No doubt exists as to the premier position held by the Lower Albany district of the Eastern Province of the Cape as a pine-growing centre. Both as regards acreage and quality of fruit it comes easily first. Natal also grows good pines but is behind in acreage, whilst East London also claims to

be a pine-producing area, though so far results have not been strikingly in evidence.

In the low veld of the Transvaal, from Barberton in the south to Tzaneen in the north, pines are also grown. In order to obtain a really perfect specimen in these districts, it is necessary to irrigate. The pine cannot be said to be exactly at home in these parts. They are a little too distant from the sea. The coastal districts from Natal right down to Port Alfred contain the most suitable soils for the pine. Rainfall is not high, with the exception of the Natal end, where they get over 40 inches per annum. The Albany district, where the best pines are grown, is at times a distinctly droughty area with serious lack of rainfall for sometimes a couple of years in succession, yet here, under the conditions described, the pine is at its best.

The largest pineries are planted within about 20 miles from the sea; the atmosphere is full of moisture and the leaves of the pine are able to extract this and use it to nourish the plant. It has been stated, so great is the ability of the plant to extract moisture from the air, that a dry and barren hillside has been known to exude streamlets of water after having been under pines for a few years. At Langholm, the largest of the Eastern Province pineries, many thousands of apple trees are planted amongst the pines; they obtain their moisture from that which is secured by the latter plant and diffused throughout the soil. Were it otherwise, the apple trees would have a hard struggle to obtain moisture enough with the somewhat erratic rainfall. In 1915, the author, at a public lecture in Grahamstown, stated that as far as fruit growing was concerned, the pineapple came first in the Lower Albany district, the apple second and the orange last. Ten years later, it is satisfactory to see this statement vindicated.

The pine does not require the very best soils in which to attain perfection. On hundreds of acres of barren hill side, with soil a foot deep and sometimes less, some of the best pine plantations may be found. Given the necessary slope for the sake of drainage, with a north and eastern exposure, land of good quality and texture will prove its value as a producer of good pines. But to plant pines on a level piece of land, however good in quality, without drainage or with only little hopes thereof is only asking for trouble. For a year or two they may flourish, afterwards they simply fade away.

Lower Albany growers suggest that only in that particular district in South Africa can ideal conditions be found. This is rather a wide statement and may be taken with a pinch of salt. It is certain that under conditions similar to those found there pines will grow equally well.

Proximity to the sea, for the sake of the atmospheric moisture

which is the life of the pine, perfectly drained hill slopes with fairly good soil, plenty of sunshine and a moderate rainfall are the natural surroundings which should be sought for.

Propagation.—Although pineapples *may* be propagated from seed and in some four other ways, namely,

Crowns,
Slips,
Suckers and
Stumps,

practice in South Africa has decided that two methods only are required and, as a consequence, planting has commonly resolved itself into the planting of suckers and stumps.

The *crown* is the top portion of the fruit, consisting of upright and slightly curved leaves, 100 in number, more or less. Crowns are cut off and planted in light sandy soil when they usually grow without difficulty. As pines are generally sent to market with the crowns attached, they are not available for propagation purposes. Canneries prefer pines delivered without the crowns, but even having plenty of them at hand in this way is not likely to lead to their use for purposes of propagation.

Slips are found on the plant just below the fruit and remain on it after the " apple " is broken off; they will grow readily but take longer than

Suckers, which are found round the base of the plant, above ground, in the axils of the leaves. The strongest of these are those nearest the ground and they are cut or pulled from the plant and set aside for planting, thrown in heaps containing many wagon-loads, allowed to remain in the hot sun week after week for months and then planted. Such is the treatment commonly meted out to pine suckers, and it is claimed that they thrive better thus than if set out immediately after removal from the parent plant.

Stumps are very largely used in the setting out of pineapple plantations. The stump is that part of the plant which has borne an " apple " and may have two or three suckers attached to it. They are pulled up altogether and submitted to the same treatment as the suckers, that is, placed in large heaps and when the ground is ready for planting they are hauled away and dumped on the land in a convenient place.

The old style was to plant stumps only and always; one result of this was that in the second year after planting a stump with its attendant suckers would bear from two to four pineapples against the one which would be borne by a single sucker.

Against this, it was contended that the use of suckers alone rendered it possible to plant thousands of acres of pines within a

very short time, whereas if stumps only were planted there would not have been sufficient to enable extensive plantations to be set out quickly. Roughly, three suckers go to one stump.

The propagation of pineapples from seed is not a business proposition. Seeds are found in the fruit itself, from ½ inch inwards from the skin and are the successors to the blossoms on pines of mature age. They are seldom found in the fruit of young plants. They are principally of use in breeding up new varieties.

Selection.—The careful grower, in thinking of planting pineapples, whether from crowns, slips, suckers or stumps, will select them from well-grown healthy plants which have not only borne good crops of fruit but pines of good quality, deep in colour, of good cylindrical shape and with large outstanding crowns. No propagation should ever take place from plants which have produced abnormal fruit such as those with double crowns; they are not wanted overseas—the canners do not want them and even local dealers eye them with disfavour. If exported, they will not reach anything like the figures paid for good ordinary pines with a single crown.

Planting.—Land for pineapples requires a deep first ploughing, thorough harrowing, levelling and reduction to a fine state of tilth. When this is completed, the pines may be planted and this usually takes place from October to January or during that period when a little rain may be looked for. The land is laid off in rows of convenient length between the roads at 5 feet apart and the pines are planted every 20 inches apart in the rows. It is customary in some parts to strip the bottom leaves for 3 inches or so before planting; in other districts the leaves are left on, the idea being that they will rot and so afford a little fertiliser. It is not a matter of great moment. It is, however, of the utmost importance, in fact it is imperative, that the suckers or stumps shall be deeply and firmly set in the ground.

Very occasionally planting in squares with the plants at 3 or 4 feet apart is done, but the first-mentioned method is almost entirely used in South Africa.

Cultivation.—As soon as planting has been completed a little rain is looked for and sometimes it comes just when it is wanted—more frequently not. In any case, when rain does come, weeds very quickly follow and it is during the first two years of the life of the plant that every possible effort must be made to keep the plantation clean and free from weeds. Hand hoeing is the best and most thorough method as cultivators cannot get in between the plants when set at 20 inches apart. Taken in conjunction with the use of the hoe, an ordinary single horse cultivator is all that is necessary to keep the place clean. Deep cultivation is *not* needed, in fact

the pines are better without it—just enough to keep the weeds in check is all that is required. It is *not* necessary to cultivate constantly at intervals of twenty-one days or so in order to conserve moisture; the plants conserve their own moisture and provided the soil mulch is fine and some 3 or 4 inches deep, frequent cultivation may be dispensed with. These remarks apply to coastal grown pines only. In the Transvaal, where the satisfactory production of pines without irrigation is not as easy, clean and frequent cultivation is necessary and once in three weeks is not too much.

Thinning and Fertilising.—The age to which a pinery may attain depends largely on the owner and on the way he takes care of it. The author has seen pineries in the Eastern Province twenty years of age, the plants having grown so thickly that passage between the rows was almost impossible. The plants ran into what looked like a solid mass of foliage and what little fruit there was was too small to be worth picking. That was neglect. A properly constituted pinery, worked on proper lines, never gets into that condition. As soon as the yield shows signs of diminishing and the fruit of becoming smaller, resort is first had to fertilisers, and in this connection it may be said that neither practical experience nor work of an experimental nature has been of an entirely satisfactory nature in South Africa. Experiments in fertilising the pineapple were undertaken at the old Natal Experimental Station at Winkle Spruit on the south coast and the value of wood ashes as a supplier of potash was demonstrated.

Unfortunately, the pines were planted on a slope which was subjected at times to very heavy downpours of rain, and as a result the higher portions of the land were denuded of fertiliser and the lower portions were too lavishly supplied. The following formula has been adopted with some success. Basic slag 600 lb., sulphate of potash 300 lb. and nitrate of soda 200 lb. per acre. The action of fertilisers is almost at once apparent in the increased size of the fruit and growth of the plants. The time eventually comes when thinning is imperative and unless it is done both plant and fruit suffer. The plan adopted is the removal of all stumps which have borne, together with a certain proportion of suckers. It is impossible to state what amount of thinning should be done, but the rows may safely be reduced in width by half, care being taken to leave a proportion of suckers which should continue the business of bearing fruit. This work is done with the aid of an iron tool consisting of a sharpened crook with a handle 4 feet long. The crook is placed round the stump, which is either cut or pulled off; suckers are removed in a similar manner. Natives are often told off to pull out the suckers, but without thick leather gloves this is not possible; the spade is often resorted to; the sides of the rows

are trimmed up and brought into shape again so that progress between the rows is once more possible.

Replanting Old Lands.—In the Bathurst district it is generally considered an impossibility to re-plant land which has once been a pine plantation with pines and bring them to a successful issue. Instances have been quoted where this has been attempted with dire failure as the result. Inquiry has, however, revealed the fact that in no instance had proper measures been adopted to re-condition the land, to renovate it and bring back some of its lost constituents. If the land to be re-planted was originally good pine land and had been proven by results, it should be possible to restore it so as to again become profitable.

The first step is to manure the plot with the commercial fertilisers, as already mentioned, at the commencement of the rainy season, say September. Broadcasting, ploughing it under and harrowing is the best way to go about it. A crop of velvet beans planted at the rate of 50 lb. per acre and ploughed under when in blossom will be the next step. Supposing this is done in October, they may—providing decent rains come—be in a fit state to plough under in December or January. The land should lie fallow for the remainder of that year and the same work done during the next season, with the difference that, instead of basic slag being used as a supplier of phosphoric oxide, a similar quantity of ordinary ground bone (of medium fineness) should be applied.

Handling the Crop.—There are two recognised crops of pines—the summer and the winter one; by far the heaviest is the one which ripens in January, February and March. Winter crops should ripen in July and August. There are, of course, variations from these dates according to the earliness or lateness of the season and almost at any time of the year one may find a stray ripe pine.

Pines are generally gathered by native women and they do the work quickly and well when under proper supervision. The pines are picked into lug boxes, taken to the pack-house, weighed, packed and dispatched either to the local inland markets, to the port of export for overseas or to the cannery, as the case may be. For local markets they are firmly packed in standard size crates which are returned to the growers after the contents have been disposed of. The export of pines will be dealt with in a special chapter on export. Those for the canneries are topped and tailed, *i.e.*, the crowns are pulled (not cut) off and any long stems left are cut off and the pines packed firmly in crates for dispatch. Naturally the very best are exported. The local markets and canneries take the next selection and many car loads are sent to the jam factories in addition.

The pine is fairly free from disease. Very hot sunny days may

occasionally scorch one side of the fruit. This occurs, of course, only during the summer months and not often then. Winter crops are free from this trouble.

During a wet season, some trouble is experienced from what is known as Brown Rot, which affects the interior of the fruit, rendering it bitter and unfit for sale. Little is known with regard to this trouble either in South Africa or any other pine-growing country, excepting that it is more prevalent in wet seasons.

CHAPTER XXVIII

BERRY FRUITS

The Cape Gooseberry

This plant, so well-known throughout South Africa, is a native of Peru (its botanical name is *Physalis Peruviana*). It has, however, so successfully established itself, first at the Cape (hence the name Cape Gooseberry) and afterwards all over the Union, that it may almost be regarded as one of our own indigenous plants. It certainly is at home in every part of the country where temperatures are warm enough for it, and thus is at complete variance with the English gooseberry, which prefers the cooler districts.

The cultivation of the Cape gooseberry has been carried on in certain parts of the Union for many years past and though no large acreages were set out until comparatively recently, numerous small plantings of from ½ an acre up to 5 acres in extent and in some cases more were to be found.

The demand for the fruit locally is fairly good, it is used by the housewife for such purposes as pie- and jam-making and it is in the latter capacity that the fruit has come to be so largely in request.

Cape gooseberry jam has of recent years become such a favourite preserve both on our own and overseas markets that the cultivation of the plant on a continuously extended scale is assured. There is no jam like Cape gooseberry jam in the opinion of many thousands of converts to its use, and as a consequence the once neglected berry has a commercial importance attached to it which is foreign to most preconceived ideas.

The fruit is so familiar that it scarcely needs description. It is almost the size of a small cherry and is enclosed in a covering of a bladder-like nature.

The plant is herbaceous and the branches are of a succulent nature and spreading habit. It reaches a height of from 3 to 4 feet, depending on the soil in which it grows and the treatment it receives. It is a perennial but when planted commercially is treated as an annual, and fresh sowings are made yearly.

Commercial culture of this berry has been largely increased by the demand from the canners and jam factories for a large and still larger output and now contracts can be secured for the delivery of almost any quantity up to 500 tons or more in a season. The increased demand has been largely due to the activities of the African Canning and Packing Co. of Port Elizabeth, which has made a speciality of the Cape gooseberry jam for export.

Although the plant is easy to grow and has the habit of seeding itself when conditions are favourable, there are many disappointments in the starting of a Cape gooseberry patch. The seed should be sown in a seed-bed and kept moist, when it will germinate readily. When the seedlings are about 5 or 6 inches high they may be transplanted and if water is available and applied at that time and is carefully used to give the little plants a good start, there is not much difficulty in getting a good stand of bushes.

They should be set out at about a distance of 5 feet apart in squares, sometimes rows are made at 5 feet apart and plants set out 3 feet apart in the rows, but as a rule this method gives insufficient room for the plants to develop properly. Cultivation of the soil is necessary and should be started as soon as the young plants have commenced to grow and continued until it is no longer possible to pass down the rows with a cultivator. A single horse implement is the thing to use, of the type of the Planet Junior. Weeds should be kept down and the duck-foot attachment is best for this; the land can be stirred for the retention of moisture by the use of the ordinary chisel teeth.

The crop ripens in different parts of the country at slightly varying dates, but as a rule it may be said that June, July and August see the bulk of it picked, although one may always find a small percentage of berries by seeking them carefully either before or after the dates mentioned.

Picking is a slow process and as the berries do not weigh heavily a good price must be paid per lb. The fruit is usually consigned to either the local market or the jam factory in the hulls, it carries better that way. Prices may run as high as 3*d*. per lb. for good fruit in the hull.

Physalis ixocarpa.—This is another type of gooseberry similar in nature to the *P. Peruviana*. It is said to have been introduced into South Africa during the Boer War in 1900 in some forage from South America. The fruit attains a larger size than the Cape variety and may measure up to $\frac{7}{8}$ inch in diameter. In colour it is lightish creamy-yellow with a pink to crimson tinge.

It is much esteemed for cooking and jam-making, but is not as general a favourite as the *P. Peruviana*. The habit of growth is similar to that of the Cape article.

The Currant

Currants are conspicuous by their absence in South Africa. Very few bushes are to be found through the length and breadth of the sub-continent. Yet there are some few districts where the cultivation of this most useful fruit might be carried on with some prospects of success.

When currants are spoken of, the minds of many turn at once

to the fruit which so often accompanies the raisin in cakes and puddings. These are really not currants at all, but small dried grapes. The currant dealt with here is that which is familiar to most of the inhabitants of Northern Europe. In its natural state there it is found in three different forms, the Black, Red and White. As a matter of fact, black currant jam and red currant jelly are better understood here in South Africa than the fruit from which these compounds are manufactured.

The currant likes a cool climate and so only the very temperate parts of South Africa can be looked upon as capable of offering an acceptable home to these really attractive fruits.

Districts similar to those mentioned as being suitable for the gooseberry provide more or less satisfactory surroundings for the currant.

Of the classes mentioned, the Black Currant may very occasionally be found here. It is able to withstand a higher temperature than either the Red or White. In England it is not uncommon to see the bushes planted between rows of apple or other orchard trees; the shade from the larger trees forms a suitable filter through which the sunlight may pass to reach the currant bushes, for the plant does not like too much sun even in England and here in South Africa its power is so much greater that it renders the growth of the currant impossible except in the very coolest parts of the country.

The Black Currant requires soil to be fertile and moist and an annual manuring is necessary for the best results. The fruit is borne principally on the young wood and the bunches are loose and straggling, containing comparatively few berries.

The plant is propagated by cuttings, much in the same way as the gooseberry, and they should be treated similarly. The best time to plant them is in March or April. In setting out the bushes a distance of 8 feet should be observed between the plants. Short stems are the rule, of from 4 to 6 inches in length; these must be freed from buds before planting, below the crotch of the trees. The idea is very much the same as when the buds are rubbed off from a young tree, as they develop in the spring and the result is the same.

Pruning should be resorted to after the first year's growth, the new wood being cut back to about one-third of its length and the following year to about one-half. The selection and leaving sufficient of the new wood at each pruning are important as the best and finest fruit is found on the new shoots.

Propagation of both Red and White Currants is exactly the same as is the case with Black. The bunches, however, of both Red and White are larger and more compact than those of the Black variety and the bushes will thrive in soils of a less fertile nature. Those to which the Red and White kinds have a decided objection are clayey and low-lying. The bushes may be set out at a distance of 6 feet in squares.

The difference in pruning comes in after the first couple of years, during which that which is suitable for the Black may be applied to both the others. When the bushes have reached three years of age and over, it is necessary to be careful not to remove too much of the older wood and when six or eight years old none but the older branches the vitality of which may appear to be impaired should be cut away. The work may be best done in July. The bushes commence to bear when two years old from the cutting and should be profitable for at least eight or more years. In England many instances may be found of very old currant bushes which are still profitable.

The Loganberry

The Loganberry is a fruit of recent introduction and is the result of a cross between a blackberry and a raspberry. It was originated in California in 1881 by Judge Logan and has rapidly come into favour all over the world.

Its habit of growth is not like either of the parents, but resembles that of the blackberry to a greater extent than the other. The canes or branches have a trailing habit and grow many feet in length during the course of a season. If left alone, they will grow quite readily along the ground and this habit is made use of in the training and pruning of the plants.

The fruit is of large size and different shape from that of either of its parents, being sometimes over an inch in length. The colour is dark red to claret. Flavour is acid until the fruit is quite ripe and even then it has rather an acid taste. The loganberry makes an excellent jelly and is used for canning and jam-making purposes besides being dried (in America). The demand in that country is greater than the supply. It is being planted largely in England for canning purposes.

The loganberry may be found practically all over South Africa and has proved a rapid, vigorous grower and fair bearer in most cases, with instances under favourable conditions where very large yields have been secured. It will stand without injury most of the temperatures to which it is likely to be submitted in South Africa and has been grown with equal success on the high veld and warmer climate of the bush veld of the Transvaal and the coastal districts of the Cape and Natal.

The plant is not exacting in its soil requirements, but like most others does best in those of good quality and depth. The red sandy loams are very suitable for its growth as are also the heavier types, whilst grey or black soils appear to be almost equally suitable. The deep alluvials of the Karroo provide excellent soils for the loganberry.

Good drainage is essential. Under favourable conditions the

plants have been known to have a profitable life for more than twelve years. Cultivation of the soil is much the same as that needed by the raspberry; it should be kept moist, loose and free from weeds. The richer it is made by an annual fertilising the larger the crops and the bigger the berries. Ordinary kraal manure is very suitable for the purpose.

Propagation is by rooting from the tips of the canes; these are covered over with soil about March and will root very easily. A whole cane may be covered with soil and then young plants may be secured at each joint. In selecting young canes for planting, it is best to take either strong, healthy one year old plants or vigorous

LOGANBERRIES.

[From *The South African Fruit Grower.*

rooted tips. Cuttings may also be utilised but are not regarded as being either economical or as suitable as rooted tips and have little to recommend them. Those plants grown from tip rooting are considered the best for general purposes.

The loganberry must be grown on a trellis of some kind. The plant is a trailer and takes up lots of room, as it bears heavy crops of fruit; it is advisable to allow a fair amount of space between plants in the row and between the rows themselves.

In any case, rows should run from north to south, so that both sides may get the benefit of the sun's rays, and in order that this may be secured rows should not be nearer than 8 feet together.

The height of the trellis will depend on the form decided on and the method adopted for training the canes.

The simplest is an ordinary upright trellis in the shape of a fence 5 feet 6 inches high with four wires (No. 10 galvanised), the first 18 inches from the ground with three or more at a distance of 15 inches apart. Strong end posts are required with ordinary fencing posts at intervals of about 20 feet. When this type of trellis is used the canes may be trained either horizontally along the wires or vertically. In the former case the plants may be set at 12 feet apart in the rows and kept within bounds. In the latter they may stand as closely as 6 feet apart; they are trained in the fan-shape and as they grow are interwoven amongst the wires.

Another method of training the loganberry is that adopted by the most successful growers of export grapes from the Western Province of the Cape. The trellis consists of an upright fence 4 feet 6 inches high with a cross-piece about a foot from the top of 2 feet or 2 feet 6 inches in width. On this foundation, three wires are strung, each cross-piece has its wire stretched along each end of it and one along the top of the posts, this gives a spread of canes with considerable surface exposed to the sun and also plenty of shade in which the finest berries are to be found. It is necessary that the posts for carrying the wires be strong, as the canes are very vigorous growers and attain a weight which would break down weak posts. They should be placed not more than 20 feet apart and the end posts should be extra strong and well anchored. It is claimed that the finest berries are grown by the use of this type of trellis.

Pruning the canes usually consists of cutting out those which have done their fruiting and the training in their place of younger canes which may have been lying on the ground. This may be done as the canes cease to yield, but is more rapidly and conveniently accomplished in December and January when all the old canes may be cut off at one operation and replaced with younger ones for the next season's fruiting.

It is impossible to speak of the yield of the berry in South Africa per acre, but in England 3 tons per acre are regarded as satisfactory, whilst in the Western States of America from 5 to 7 tons are expected. The culture of the loganberry is worth exploiting; it is too much neglected in South Africa and the same may be remarked with regard to all other kinds of berries

The Gooseberry

What is commonly known as the English Gooseberry is only to be found in South Africa in very small numbers. It would be incorrect to say that it is not grown here, as there are certain instances

on the high veld of the Free State, Natal and the Transvaal and also in the Eastern Province of the Cape in the neighbourhood of the Hog's Back, where a very moderate amount of success has been achieved in the culture of this fruit.

The similarity of parts of South Africa to certain districts in California is again emphasised, in that very few portions of that State are suitable for the growth of the gooseberry. Supplies are available in small quantities from the coastal areas on the Pacific, but the bulk of the gooseberries consumed in California come from the neighbouring State of Oregon, to the north.

Importations of a number of different varieties were made into the Transvaal in 1904, both from England and Australia. The little bushes were clean, healthy and well-grown on arrival. They were planted at Ermelo in suitable soil and surroundings at the Government Experimental Orchard there and after a somewhat chequered career and being submitted to flood and hail, they, when some three years old, bore a few berries. The bushes were then about 10 inches high. Other importations have since taken place but without much success. The district of Wakkerstroom, Transvaal, has had, more perhaps than any other, experience in the growth of this fruit.

From a commercial viewpoint the gooseberry may be said to be non-existent in South Africa, and there is not at present any prospect that interest will be awakened in the culture of the fruit. To the bulk of our population it is a strange and not very interesting one — the Cape gooseberry being the only one with which they are acquainted.

For the information of the few who may be interested it may be said that the most suitable localities are those with a moist atmosphere and thus the coastal areas would be indicated, were it not that, generally speaking, they would prove too hot. Those portions of the high veld which are situated in the " mist belt " in Natal, the Orange Free State and Transvaal and some few parts of the Eastern and Western Provinces of the Cape should afford suitable climatic conditions.

Rich loam or black soil, kept moderately moist at all times and sheltered from the sun's rays as much as possible, is what the gooseberry bush delights in and for regular and plentiful crops an annual dressing of ordinary stable manure is as good as anything.

Propagation is easy, and is confined to cuttings unless the origination of new varieties is contemplated, when seeds are used. Cuttings taken either just before or just after the winter months root easily, possibly the best month would be May. The usual length is about 9 inches, two-thirds of the cutting of which is buried with one-third remaining above ground. Training the bushes

is usually confined to the practice of having one stem only. It may be 6 to 9 inches long, about 8 to 10 branches are allowed. These are thinned out annually in July by the removal of the old wood. The bushes may be planted 6 feet apart and they should be kept free from suckers. For garden purposes and the supply of a few choice berries for home use, the smooth green and red Champagne are good varieties to plant.

It may be of interest to state that the late Mr. Fuchs, one of the most skilled nurserymen in South Africa, had at his place in Johannesburg a gooseberry bush which is now nine years old, about 15 inches high and it has borne one berry during that period

The Blackberry

It is questionable whether the Blackberry is not regarded more as a weed than as a fruit-bearing plant in many parts of South Africa. "Brambles," as they are commonly called, have an unfortunate habit of spreading in all directions when some enthusiast plants them with the idea of cultivating them for the sake of fruit and after a time loses interest and leaves them to look after themselves, they do not hesitate but proceed to take possession of all the surrounding land—then they are called a nuisance.

The bramble grows in many parts of the country in a state of wild profusion where suitable environments are found. The fruit finds a ready sale at the canneries and jam factories and is gathered by women and children and disposed of at so much per bushel basket.

Few attempts have been made to introduce any varieties of superior quality of late years. The author, in 1904, brought in some of those which were considered to be most suitable for Transvaal conditions and they were planted at the Government Experimental Orchard at Potchefstroom. For a few years they did very well and gave good crops of excellent fruit, but owing to the pressure of work in other directions, with changes of management at the Station, interest in them was lost. The varieties which showed up most favourably were Mammoth and Maxwell.

In Natal, Col. Green also introduced specially selected varieties, but after a few years they spread in the way mentioned and became a nuisance.

Very little interest is taken in the culture of the blackberry in South Africa. Near Johannesburg there are a few growers who supply small quantities of fruit during the season but, commercially, the blackberry can scarcely be said to exist.

The culture of the bramble should not, however, be lost sight of. It is distinctly one of the most prolific and profitable of berry

fruits and there are not many places where it may not be planted with good prospects of success. It is what may be termed a " small holding " fruit and many an owner of a little farm in America has been thankful for the few hundreds of dollars he has annually taken from an acre or two of blackberries. In that country the culture of the fruit has assumed very large proportions and much time and study have been devoted to the selection and production of the best sorts of berries.

There is no secret to be discovered as to how to grow the plant and raise the fruit, the trouble is perhaps that it is so simple, yet like other fruits, even in the blackberry, quality counts, early and late varieties pay better than mid-season ones, and how to get the best and most profitable demands a little thought, and the maintenance of a patch of blackberries more than a little care.

For these reasons a few hints follow in connection with the most approved methods of blackberry culture with the hope that they may prove of use.

The plant will grow in almost any soil, but thrives best on a good deep loam, chocolate coloured, grey or black. Unlike the raspberry, which will die from drought and neglect, the blackberry will continue to spread and bear fruit of an inferior kind even in dry localities, but for the production of a commercial article the soil must be kept moist, loose and clean. The surface must be stirred thoroughly at frequent intervals to keep down weeds and suckers and retain moisture near the surface. No deep cultivation is required, work with the Dutch hoe is sufficient for garden purposes and if field work is undertaken, a one horse cultivator with duck-foot teeth is all that is needed, the roots are near the surface and if cut by deep cultivating tools will at once start to throw up suckers.

Blackberries are usually propagated from suckers taken from the base of the plant round the main roots, but if a large area is to be planted out, roots of the desired variety are taken and cut into small pieces about 2 or 3 inches in length. These are planted in good soil 3 to 4 inches deep and soon produce rooted plants which will be ready for setting out at the end of the first year's growth.

The method of planting depends on the purpose for which they are grown; if for the garden they may be put in any convenient place where they are getatable with a hoe. If on a large scale for field cultivation they should be planted in rows at least 8 feet apart and 4 feet apart in the row; the space between the rows must be kept cultivated and free from suckers and handy for picking purposes, but that between the plants in the rows will soon be filled up with more shoots and canes and these form the fruiting base of the patch.

The best growers in America look after their brambles with the utmost care, staking the young plants when first set out and only pinching off the tops when the canes have reached the height of about 3 feet, at which height a wire is stretched along the rows. A trellis of sorts is formed by means of a couple of wires set one above the other at a distance of about 18 inches apart. No. 10 wire should be used and fastened to posts placed 20 feet apart in the rows. Th lower wire should be 18 inches from the ground, the top one being 3 feet. The canes are tied up in bunches to the wire, or some growers stretch two or more wires parallel to the first and about 15 inches away from them, and grow the plants between the rows of wires, the latter is a favourite method.

Pinching the tops of the canes induces the throwing out of fruiting laterals and these bear the following year. Some growers do not give any kind of trellis support, but allow the canes to grow naturally and unaided. When this system is adopted the canes are beheaded when just 4 feet high and laterals are thrown out from these, the shorter canes do not need support as do those allowed to attain a greater height. The plants are set at the same distance throughout.

After the canes have borne a crop of fruit they are cut away; this may be done in July, or, as with other berries, the canes may be removed when they have finished bearing. The new ones are then ready to take their place and the patch is continued. A well-cultivated stand of blackberries should last six or seven years, or perhaps more.

The berries are picked and packed for market in the same kind of chip baskets as those used for raspberries; in fact this style of packing is well adapted for use in packing most berry fruits.

The Raspberry

The Raspberry is largely grown in Northern America, Europe and the Australian portions of the British Commonwealth of Nations. It is indigenous in different types to both Europe and America, also to the Transvaal, where it may be found in a state of nature; the fruit is a true raspberry, yellow in colour.

The berry is not extensively cultivated in any part of South Africa, indeed the parts where it succeeds are not too numerous. The Western Province of the Cape, where almost every kind of fruit is to be found growing in profusion, is not at all suited, as a general rule, to the growth of this berry, though there are spots where it is found. It thrives best in the colder parts of the Transvaal, Free State, Basutoland, Natal and the Eastern Province, in fact in those parts of the country where conditions to a certain extent somewhat resemble those which are to be found in Northern Europe.

The raspberry is only seen in small quantities on any of our markets and it may safely be said that the cultivation of this very favourite berry has been sadly neglected. There is no apparent reason for this, unless perhaps the idea has got abroad that the canes might become a nuisance and spread indefinitely, as is so frequently the case with the blackberry in South Africa. This, however, would not be likely to happen, as the raspberry canes would be quite likely to die if neglected and kept without moisture. The berry has been grown in the Government Experimental Stations at Potchefstroom and Cedara with considerable success, the latter institution has distributed many thousands of canes and yet no plantings of any note have taken place. Probably the largest acreage of raspberries may be found near Johannesburg and in Basutoland.

The culture of the fruit is simple and with proper soil, well cared for and fertilised, a good water supply and careful attention to the canes, the raspberry can be made to bear from the early summer months until the frost comes and puts it out of action. The yield is difficult to estimate as there are so few engaged in the growth of the fruit commercially, the bulk of the raspberries we grow being those produced in private gardens where the fruit is a highly successful and welcome addition. Prices for the berry when offered for sale are usually of a satisfactory nature.

Soils.—The selection of soils suitable for the raspberry is not a difficult matter as it has no special requirements. The canes will grow in any but the very poorest soils, provided that they are capable of being kept moist. Red soils are perhaps hardly as suitable as the darker chocolate; and black soils, when not inclined to bake too hard, may also be used, indeed a good black soil is very suitable for the growth of good raspberries. One rich in humus, with a good depth, should be selected if available, as the canes put on a more vigorous growth and the fruiting qualities are enhanced. Fertilisers should be attended to in order to maintain fertility, and ordinary kraal manure or even stable manure may be freely applied. Wood ashes dug in round the canes prove a good source of potash. The best time to apply fertilisers is at the end of September or as near as possible before the rains commence in the regions of summer rainfall and in July in other quart.

Situations for raspberries should be chosen with an eye to select as cool a site as possible, one enjoying the shade from large trees but far enough away from them is suitable for garden purposes, whilst for larger plantings a slope on the cool side of a foothill range with a northern and eastern exposure is suitable. It must be remembered that the raspberry is not a tropical plant and consequently very hot situations should be avoided.

Irrigation.—For the successful growth of the canes a good supply of water is imperative. The soil should always be kept more or less moist and a small permanent supply will effect this better than flooding the land with large quantities at intervals. With irrigation, cultivation should be closely associated and the soil around the canes kept loose; if these practices are carried out, the canes are kept in good health and the fruiting season is lengthened.

Culture of the Raspberry.—The natural habit of the raspberry is for the roots to spread and throw up a number of canes annually. These canes will bear fruit in their second year, sometimes at the end of the first, if so desired, but as a rule this is not customary, unless late fruit is wanted when the young canes will bear after those in their second year have finished.

It is customary in setting out a patch of raspberries to plant young suckers taking them away from the old roots about May or later and planting them in whatever fashion may have been decided upon. Methods of planting may be as follows:—

1. To set the canes in straight rows along a wire support which may be 3 feet 6 inches high, with another wire between it and the ground at half the distance. Plants are set at 18 inches apart in the rows and the rows 8 feet apart.

2. To set the canes between two wires about 2 feet high in beds of desired length having a space between the wires of some 4 feet 6 inches, the canes to be planted in rows about 18 inches apart.

3. To set the canes in bunches of four with a centre stake about 6 feet high in the centre of each bunch. This is the old-fashioned English method and gives very good results if quality and yield are what is desired, as also does the first method mentioned. When, however, quantity is desired No. 2 planting method is the best. The plants are usually allowed to grow more densely and to yield large quantities of possibly rather smaller fruit, though this does not of necessity follow as there is no need to allow overcrowding.

Planting takes place during the late autumn or winter months, the soil must be moist and loose and well firmed round the roots of the canes when they are set out. The canes should be cut back to about 6 inches high from the ground, they should grow rapidly and become well established by the following December or January, the growths of the first become the bearers of the second year. After bearing, each cane is cut down, in the ordinary course of events in the following winter, and those coming on form the bearers for the coming year.

Whichever method of planting is adopted crops of a continuous nature are sure to be desired and can be secured by judicious pruning of the canes—in removing each cane just as soon as it

has finished fruiting, the energy of the roots is then drawn upon by the next cane, which should have previously been beheaded in order to induce the throwing out of laterals—later canes may be cut back to induce them to throw out laterals also, and these may be allowed to remain and become the earliest fruiters of the following year.

Raspberries are best marketed in the small chip baskets or punnets, which are usually placed in a tray containing either 6 to 12 punnets, they are shallow in order that little weight shall be placed on the lower layers of fruit. As stated, they are altogether too scarce on our markets and South African jam factories are compelled to get their supplies from Basutoland, where some attention is paid to berry culture, or to import the pulp. In 1924, the imports of various kinds of pulped fruit from Australia alone amounted to 194,942 lb., valued at £3,417, and from Holland 32,099 lb., valued at £546.

Varieties.—The Cuthbert, an American variety and one of the best, has proved the most successful of all hitherto grown in South Africa. It has fruited from November to April, and later. It is a particularly vigorous and healthy-growing cane, yielding a fruit of high quality and good flavour.

Red Antwerp.—This is the common variety often seen in gardens; it is a fair grower and bearer, nothing like as vigorous as the Cuthbert and does not attain the same height, nor does the berry get to be as large, still the fruit is an acceptable one.

These two are about the only varieties listed by our nurserymen, though the yellow one is mentioned by Carter and Co., of Maritzburg.

The Strawberry

The Strawberry is indigenous to the Northern Hemisphere and is found in its wild state in that portion of both Europe and America. The tiny fruits, the size of a pea more or less, have the real "Strawberry" flavour in the most delicate form, on which the hand of man after scores of years of breeding and crossing has not been able to improve. The question of size has, however, presented less difficulty and very large strawberries are now the order of the day. It does not follow that the largest are the best flavoured, neither have they the solid flesh of some of the smaller sorts, which lend themselves in a more satisfactory manner to the production of the choicest strawberry jams in which the whole berries predominate to the exclusion of pulp.

The plant is a perennial and will continue reproducing itself by means of runners for some years. As, however, the fruit produced on old plants is inferior in both quantity and quality, it is

customary to allow a plant to produce fruit as a rule for two years only, occasionally a prolific bed may be allowed to remain for three years, but that is the limit beyond which it is not profitable for old plants to remain.

The system of starting new beds every year has proved most successful and the old method of making the best of things by breaking up the old plants into sections and replanting them has been entirely superseded.

Methods of planting out into beds have also been changed. The old custom was to set out beds about 3 feet in width with plants 15 inches apart and leave them alone. The result was an enormous mass of runners and young plants in an altogether too crowded position, the production of a few large berries and many small ones, which was not exactly what was wanted.

This kind of planting has been superseded by other methods which admit of more space being allowed for each individual plant and has resulted in the adoption of long, narrow rows set out at about 30 inches apart, with plants at a distance of 15 to 18 inches in the row. The fruit borne on these plants is large and plentiful. Space is allowed for the runners on each side of the row and the first two plants on each runner are allowed to root. As more runners are put out they are cut off and not allowed to grow; this admits of the selected few getting plenty of nourishment. The original rows are thus allowed to extend by the rooting of the runner plants on either side for a couple of feet in width or perhaps a little more.

Single rows of plants are also occasionally used and allowed to remain for one year only and then are turned under. Advocates of this system state that it is equally as profitable as other methods; all the fruit is large, it can be kept mulched both sides of the row and is therefore cleaner than fruit from matted beds.

The mulching of strawberries is scarcely ever practised in South Africa, certainly not in commercial plantings. Our strawberry culture resolves itself into two classes—those who plant for markets and jam factories and those who want some in their gardens. The mulching process, the keeping of the berries off the ground, by placing straw or litter of some kind under the fruit, is quite feasible in garden culture, but is hardly likely to be adopted in commercial planting in South Africa.

Districts and Soils for Strawberries.—Strawberries are found in the neighbourhood of Stellenbosch at the Cape growing successfully on soils of an exceedingly light and sandy nature. The culture of the fruit is carried on in that district on a larger scale perhaps than in any other portion of South Africa.

The strawberry will grow with equal success on land of a heavier

type and may be found flourishing in red and chocolate loams and even in black soils in parts of the Transvaal and Natal. As a rule, deep, moist, but not wet loam of almost any description will provide a suitable site for a strawberry bed providing that water for irrigation purposes is available. There is hardly any portion of the year when strawberries are not to be had in some part or other of South Africa. They are to be seen in the shops from July to the following June.

Difference in seasonal rainfall makes no difference to the plant and whether rain falls in the summer or winter the strawberry thrives equally well. From sea level to an altitude of 6000 feet in the different provinces one may find the plant flourishing and bearing regular crops. Development in the culture of this berry takes place naturally in those areas where most demand is present and for that reason one finds the greatest acreage in the neighbourhood of Capetown whence canneries are supplied in addition to local markets, and round Johannesburg, where the largest local demand in the Union is to be found.

In the warm, frostless climates along the coast and in the adjoining districts strawberries may be had during June and July and it is the supply from these parts which enables South African town dwellers to enjoy this delicious berry during that portion of the year when it is unobtainable from most inland sources.

Irrigation.—A supply of irrigation water is indispensable if regular crops are to be secured. The plant has but a small root system and the roots are found near the surface of the ground; in fact, the strawberry is a shallow-rooted plant and for that reason irrigation must be fairly frequent, and especially so in the hotter parts of the country, where evaporation is extremely rapid and mulching is not practised.

The looser and lighter the soil is the more water is required, thus at the Cape the light sandy soils may be watered as often as once in three days, whilst in heavier soils, more retentive of moisture, a weekly watering may prove sufficient. It may be said that for regular and plentiful crops irrigation is an absolute necessity, and must be continued, especially through the hot and dry summer months at the Cape, as well as in the regions of summer rains, unless they should fall just as needed, which is unusual. Without irrigation also, the size of the fruit is likely to be small, but fertilisation is also a factor in this matter. There are some districts where it is possible to get on with less irrigation than others, such as the humid portions of the N.E. Transvaal and Natal, and a few parts of the Eastern Province of the Cape and Griqualand East, but these are not properly speaking within the commercial strawberry growing area at present.

Propagation.—Is undertaken for ordinary purposes solely by the planting of runner plants and only the best and strongest of these should be used for the purpose.

The raising of plants from seeds is possible, but only resorted to for the sake of originating new varieties. The process is quite simple; the seeds lie on the surface of the skin and look like tiny yellow dots. When fully ripe, choice berries are selected and these may be taken from any plant, the skin is removed by cutting it off in thin strips just as one pares an apple. The strips are washed and young plants may be easily raised by setting the seeds in shallow boxes, either in sand or very light sandy loam and covering them over lightly with the same material. After this treatment the boxes should be placed in a moderately warm yet shady spot and kept damp but by no means wet. A good deal of patience is required for this business and it may be just as well, if one is not an enthusiast, to allow someone else who is deeply interested to undertake the gamble, for it is little less, of endeavouring to raise some new variety which shall surpass the old favourites.

Runner plants, by means of which the plant is reproduced, are thrown out, as a rule, after the first fruiting of the season has finished and it is from them that future plantings are made. A plant may throw out numbers of runners which may have numerous little plants attached at intervals of a few inches, all of which would take root. It has been found that the first two or three carried on the runner, nearest to the old plant, make the best and strongest growths, whilst those nearer the extremities are apt to lack vigour; as a consequence, it is the practice to constitute new beds from amongst the first two or three runner plants. These will bear the next season.

Dividing the crowns of old plants is still occasionally practised in the case of a few varieties which put forth no runners and as a consequence cannot be propagated by those means. These are mostly Alpine sorts and do not enter largely in the lists of the ordinary nurseryman. The Alpine strawberries are used principally for seeding and crossing purposes and it is by the latter means that what is termed " perpetual " bearing varieties have been evolved. The said word " perpetual " should not be taken too literally.

Preparing the Strawberry Bed.—No matter what the soil may be which has been set aside for strawberries there are a few principal points to bear in mind:—

It must be rich and fertile.

It must be in a state of perfect tilth.

It must be irrigable.

It is not advisable to use new land for strawberry beds. Land which has carried a crop of some kind needing thorough cultivation

is most suitable. There must be no clods, the roots of the plant require soil to be reduced to the finest possible tilth, in order that they may be better able to assimilate the life-giving, moisture-carried food it contains. Fertility is secured by the addition of large quantities of stable or kraal manure and as a rule commercial fertilisers are not very much used. If the manure has been applied to the crop of the previous year, all the better, it will have become properly decomposed and readily available.

For garden requirements, where the demand frequently calls for large fruit, commercial fertilisers may be applied in small quantities of say, 2 lb. sulphate of ammonia, 3 lb. of superphosphate and 2 lb. of sulphate of potash per square rod, with ordinary well-rotted kraal or stable manure in addition, say ½ doz. baskets (bushel) to the square rod. When the spirit of emulation enters into the question of strawberry culture, greater interest is displayed in the growing of this most luscious fruit and more land, together with more time and thought, are allotted to it.

There is no fruit of any description which yields greater or more satisfactory returns within a very short period than the strawberry. The irrigation of garden strawberries is a comparatively small but important matter. When commercial plantings are under consideration it is advisable to secure water by gravitation if possible and the necessary arrangements for its application made in the laying out of the planting scheme. The Chinese gardeners, who were formerly the principal strawberry growers in California, used very simple methods. Land was chosen lying very nearly level and furrows were ploughed turning up the soil in hills from 2 to 2 feet 6 inches across in which the plants were set and water was run down between the rows in a fairly constant but small stream. This method is perhaps the best to adopt if the soil is sufficiently loose and porous to admit of the water being drawn up to the surface. Weeds are easier to keep down and the furrow between the rows affords room for the hoers and pickers to move about freely.

The reverse to this method is occasionally seen; the furrows are slightly raised above the level of the land in which the plants are set, and the water is allowed to flood them when needed. The plants usually occupy a space of about 2 feet in width. Under this method picking is rather more difficult and takes longer.

Planting.—As a rule, late winter or spring planting is better than that which is done in March or April, or "fall planting," and is more generally in use here. Fall planting, however, has its supporters who claim that they get a better spring crop than is possible from plants set out in August. Either method is successful provided care is taken in the actual planting work. Whenever it may be

decided to plant, the land must be moist, so as to enable the rootlets to " take hold " at once. Proper planting is most essential; it takes some time, it is true, but it pays. For the purpose of garden planting there is rarely need to hurry matters and when extra fine plants and fruit are sought for they are more likely to materialise when planting is very carefully done. All young plants for setting out should be brought to the land in a damp sack or in a box or basket covered with wet canvas, the roots must on no account be allowed to dry out.

Roots and tops must be trimmed, most of the leaves should be removed and all the old ones, only leaving a few healthy young ones sufficient to carry on with.

The roots should all be cut back, allowing them to remain at a uniform length of from 2 to 3 inches or so. This work should be done by the planter, but when large areas are being put in it may be attended to by an extra hand, whose business it is to prepare the plants for the planter and hand them to him ready to put in the ground, they should not be thrown down for the planter to pick up and put in, they are liable to get lost or dry and thus probably be unsatisfactory.

Special methods of planting are rarely resorted to, but if one is very particular indeed, then a scoop of soil, a couple of inches deep from the surface may be removed by the hand, a little cone of earth formed in the centre and the roots spread out in every direction over the cone, the soil is then brought up round the plant by hand and made firm round it. Plants should at all times be set rather above than under the ground, perhaps at the level but never below. After setting they should be kept moist for at least a couple of weeks.

Ordinary methods of planting are either by means of a spade, which is mostly in vogue, a dibble or by hand. Planting with a spade is quick and simple. Usually a line is set and the spade inserted in the ground at the right intervals drawn gently back and forth and withdrawn, leaving a space into which the plants are placed with outspread roots, the soil is then brought together from either side and firmed by treading around the plant.

Planting with a trowel or dibble is slower work, but conducted similarly to that done with the spade and needs no further description. The method is not as widely in use as the first-mentioned and is more suited to gardens than field work. Hand planting is still slower and not much in favour, but the same method is observed throughout. Provided the soil is kept moist and reasonable care taken loss in transplanting is usually trivial.

Much will depend on the after care of the strawberry bed; when properly looked after there is no fruit which responds more readily

or more generously than the strawberry, but certain things must be done.

For instance, the beds must be kept clean and free from weeds. For garden culture it will be found most satisfactory to mulch the soil under the plants with straw or long grass, which will form a clean bed on which the fruits may lie without becoming covered with sand or soil; the retention of moisture near the surface of the ground so that the roots may be able to obtain it; the removal of all runners not destined for use for further planting; the removal of leaves from the plants, either by sickles or mowing at the beginning of the winter; and the spraying of the plants with Bordeaux mixture to control strawberry leaf spot, the only disease to which the plant is subject in South Africa.

If the bed is to be allowed to remain for longer than two years then a top dressing of manure may be scattered over the plants after the last winter's cropping of leaves; this should, in the area of dry winters, be forked in as far as may be possible and the bed well irrigated so that the roots of the plants may benefit. In the districts of winter rains such irrigation is unnecessary.

Varieties of Strawberries Grown in South Africa.—The blossoms of all varieties are either what is termed perfect or imperfect. Those which are perfect are self-fertile, the so-called imperfect ones are self-sterile. Self-fertile ones have staminate and pistillate blossoms whilst the imperfect ones have pistillate blossoms only and as a consequence staminate varieties must be planted amongst them or they will not bear. Wickson, in his "Californian Fruits," advises that pistillate varieties should have staminate ones set out in every fourth row, *i.e.*, three rows of pistillate and then one of staminate. It is necessary, therefore, to exercise a good deal of care in the selection and planting of varieties. Many of the sorts of late introduction are self-fertile, and some of our nurserymen stock no others and so do away with any possible disappointment. Almost all the celebrated English varieties have both staminate and pistillate flowers. The following are the most widely planted in South Africa:—

"*The Old Cape*" *Strawberry*, known by no other name and is very largely cultivated in the vicinity of Capetown. A good and regular bearer of large roundish fruit, not particularly highly coloured.

Royal Sovereign.—An English variety bearing good crops of large, red coloured fruits.

Laxton's Noble, held to be the largest early strawberry, is also an English variety. Messrs. Gowie and Co., of Grahamstown, speak very highly of it and recommend it for planting in the Eastern Province.

Melba is an Australian variety which has done well in South

Africa, it is an excellent bearer of large brilliant red berries of choice flavour, and bears on runners as soon as rooted. Foliage very thick; a good sort for planting in matted beds.

British Queen.—A good late sort of English origin. Fruit large, pale red, roundish shape and of fine flavour, has done well in South Africa.

Red Alpine.—A regular bearer of heavy crops of small to medium size berries, firm flesh, good bright red in colour. Like all Alpine varieties has the aroma of the wild strawberry.

Suavis.—Mid-season. An exceedingly vigorous plant bearing long wedge-shaped fruit of bright red colour. Called everbearing.

St. Joseph.—The most likely of all the so-called perpetual bearers to give satisfaction. The plants are vigorous and the fruit is large, of round shape, trending towards a point.

CHAPTER XXIX

THE CITRUS FRUITS

Citrus fruits grown in South Africa embrace the Orange, Lemon, Naartje, Grape Fruit, Lime, Kumquat, Shaddock and Pompelmous. The order in which they are placed represents, at present, the importance attached to each from a commercial point of view, though it appears likely that the grape fruit will soon have a more prominent position in the list.

Originally introduced into the Cape by the early Dutch Governors by means of trees from Madeira and by seeds from Batavia, the orange arrived on the south-eastern coast of the Continent through Portuguese channels. That it found a most congenial home throughout the sub-continent is fully apparent from the present extensive cultivation of the tree, which is extremely widespread throughout the Union and is to be found in every Province, including the South West Protectorate and even the Orange Free State.

No members of the Citrus family can be successfully grown on a commercial basis in climates where frost is prevalent in winter to an extent of more than a few degrees. Such climates as may be considered sub-tropical, to those verging on the tropical, are those in which trees of this family are found at their best and so it is that cultivation of the orange is largely confined to some degrees north and south of the Equator. The range is from 40° North in Portugal, 44° in Italy, 37° in Asia Minor, 34° in China, 37° in California to about 35° in South America, 34° in South Africa and 37° in Australia. The bulk of our oranges are grown between 18° and 34°.

Most of the citrus fruits grown in the Union are to be found in those districts which are subject to a summer rainfall, and include large portions of the Transvaal, Natal, the Eastern Province of the Cape, the South-Western Protectorate and a small portion of the Orange Free State. The sole area rejoicing in a winter rainfall is the Western Province of the Cape and interest is chiefly centred there in the cultivation of stone fruits and grapes, the Citrus family being only a minor consideration.

For a number of reasons, the regions of summer rainfalls are best suited to the growth of the orange. The fruit ripens during the winter months, when the atmosphere is dry and all conditions are favourable to the picking and handling of a citrus crop.

Summer rainfall provides the trees with a supply of moisture just at the right time, *i.e.*, during the growth period. In a region of dry summers evaporation is extremely rapid, whereas in the case of a wet summer, loss of moisture from this cause is very considerably reduced. Everything may be said to be in favour of the culture of trees of the Citrus family, no matter of which branch, in the areas of summer rains.

Frosts such as those known in the U.S.A., and more particularly in Florida, have not, so far, been experienced within the history of citrus culture in South Africa. Even in California, which is the premier orange-producing State in America, precautions have to

PICKING ORANGES FROM TREES SIX YEARS OLD IN THE ORCHARDS OF H. L. HALL & SONS, TOMANGO, TRANSVAAL.

be taken in certain districts in order to prevent loss of fruit and damage to trees by frost. It is possible that during the past few years, during which perhaps a couple of millions of citrus trees have been set out in South Africa, some few have been planted within the danger zone. This lies at a temperature of or below 24° Fahr. Very high temperatures are also not particularly to the liking of all citrus trees. This is especially the case when trees with a scanty covering of leaves, like the Eureka Lemon, are subjected to the scorching rays of the afternoon sun. Lemons are more subject to sunburn than any other kind of citrus fruit.

Hailstorms are amongst the drawbacks with which the orange grower in South Africa has to reckon. Very few of our districts are absolutely free from their occasional occurrence, but while the

knowledge is widespread that hailstorms are possible during the summer months, it is a fact that the planting of citrus orchards, principally oranges, has increased at a more considerable rate than has that of any other class of fruit tree in the Union. The author has seen on occasions orchards which have suffered from the effects of a hailstorm. Sometimes half a crop has still been gathered. When an exceptionally severe visitation occurs, which is fortunately not of frequent occurrence, the effects are seen in the battered condition of the leaves and branches. An out-of-season crop may come along, but in a year or so the trees have resumed their customary habit of regular bearing—there is, indeed, no more regular bearer and consistent cropper than a well-cared-for orange tree.

High winds, constantly blowing from one quarter, are a decided disadvantage when orange trees are to be grown in the same locality. For the production of good and regular crops, calm and fairly still atmospheric conditions are imperative. If no position can be found which is so sufficiently sheltered as to be safe from winds, then some kind of quick-growing tree should be planted as a windbreak. There are a number of such from which to choose, all more or less suitable for the purpose. The quickest and best grower is the *Eucalyptus Saligna* which will frequently put on a foot per month. Against this is to be considered the wide root area required by all gum trees which tends to impoverish the soil in their immediate vicinity. Should this class of tree be used, a trench should be cut some 10 feet or so away from them, about a foot wide and 3 feet deep. The trench should be allowed to remain open and will effectually prevent the roots of the gums from travelling amongst the trees in the orchard. Eventually, when the citrus trees have become big and strong and capable of sheltering each other, the gums can be cut down, and utilised or turned into money. Other kinds of trees used for windbreaks are *Grevillea robusta*, *Casuarina leptoclada* and occasionally one of the *Cupressus* such as *Arizonica*.

The study of atmospheric conditions is desirable prior to the planting of any orange grove. The fact is becoming more fully recognised that some classes of trees will thrive in situations and districts where others will certainly not do so. This is even the case with different varieties of the same family. It has been demonstrated, for instance, that the grape fruit or pomelo does better within the influence of coastal atmospheres than either the orange or the naartje. On the other hand, the two latter fruits improve as they are found further inland; both colour and quality are better. The sun is undoubtedly responsible for the change, deepening the colour and increasing the sugar contents of the fruit.

Citrus Nurseries and Stocks.—The propagation of young citrus trees of all kinds is done in the nursery, just as is the case with trees of a

deciduous nature. Soils for the nursery should be from medium to light loam, deep and easily friable and so situated that an abundant supply of irrigation water is obtainable. Citrus trees of most kinds, but especially the orange, were formerly raised by means of planting seeds of the trees themselves in the hope of securing another tree which should bear fruit identical in appearance and quality with that of its parent; such trees were in the true sense of the word "seedlings." That practice is now obsolete, excepting when used for stocks, for budding or grafting on.

Citrus trees may also be raised from cuttings of either roots or branches of any member of the Citrus family; it is, however, a profitless undertaking. The practice of propagating by means of inlayers is also obsolete. There are, however, a few points in its favour, such, for instance, as the absolute certainty of obtaining fruit identical with that borne by the parent tree, its early bearing and the ease and cheapness with which the inlayers can be produced; as a commercial proposition the propagation of orange trees by means of layers is an impossibility. How many years would it have taken to produce the two or three millions of trees recently planted in South Africa by means of layers?

Further objections are raised to the use of layers. Trees grown from layers are more susceptible to disease than when grown by any other method. Such trees always have a shallow rooting system and are thus more readily affected by droughty conditions.

Modern nursery practice in South Africa has decided on the use of the rough lemon as a stock on which to bud most classes of citrus fruits. The exceptions are the naartje and the kumquat; these will also grow on the sour lemon roots, but others have been found which are considered more suitable.

The trifoliate orange (*Citrus trifoliata*) has been used as a stock for the kumquat with the best results, also for the naartje, though the growth on the tree on this stock is slow. The fruit produced is, however, of the very best quality. Oranges budded on it with a few exceptions are not a success. Most late-fruiting sorts do fairly well, but Navels and other varieties which ripen early are very considerably dwarfed by its use.

Sweet orange seedlings are sometimes used for stocks by those who do not care altogether for the rough lemon. They are rather more difficult to handle in the nursery, being of slower growth, but they produce fruit which is of the best quality and may be exported the first year after the trees come into bearing. Orange trees grown on orange seedlings make bigger trees than when grown on lemon roots, but they are a little longer about it, as a rule.

Grape fruit is also sometimes used as a stock; so far experience has not shown any advantage in its use, with the possible exception

of the grape fruit itself. In certain districts it has done well, still, most nurserymen put faith in the rough lemon as stock for this fruit. The rough lemon has the following advantages:—

1. It is the easiest of seeds to germinate.
2. It is the easiest of all stocks to bud.
3. It enables trees worked on it to start growing more quickly than any other stock.
4. It is a hardier stock and produces a hardier tree than any other stock.
5. It will tolerate drought conditions better than trees grown on any other stock.
6. It is less susceptible to "collar rot" than most other stocks.

It has disadvantages also as follows:—

1. The stock influences the shape of the fruit in that there is a decided tendency to produce fruit more elongated in shape than when grown on orange roots.
2. It has an influence on the quality of the fruit for the first few years after the trees have commenced to bear, and renders it unfit for export owing to its liability to become dry, slightly sour or perhaps flavourless. When the tree has reached some seven or eight years of age this influence disappears and no difference can be detected between fruit grown on lemon roots and that grown on orange roots.
3. The skin of oranges worked on lemon roots is liable to be, and often is, coarser than when budded on orange stocks.

The fact remains that nine-tenths of the orange trees grown in the Union are budded on lemon stocks.

Citrus Stock Summary.—Oranges succeed when budded on rough lemon, also on sweet orange and *C. trifoliata*—the latter stock is suited to late kinds only. Bitter Seville orange, pomelo, shaddock and pompelmous are not desirable. Lemons do best on root of the rough lemon. They will succeed also in some districts which may be damp on Bitter Seville orange, but it cannot be recommended for general use. They are not a success on *C. trifoliata*, sweet orange or grape fruit.

Naartjes.—The naartje does best on its own roots. On sweet orange it also makes a good tree and on *C. trifoliata* it yields the very choicest of fruit, but may be slightly dwarfed in growth. Naartjes on the sweet type of rough lemon do fairly well, but should not be budded on the ordinary rough lemon roots, on grape fruit, pompelmous or bitter orange.

Grape Fruit succeeds practically everywhere on rough lemon, and

on its own roots best in coastal areas. Experiments with all other stocks by the author have proved negative.

Citrons are frequently grown from layers and fair results are obtained. They can also be grown on their own roots or on lemon stocks.

Limes.—Many limes are grown as seedlings and as a rule come fairly true. They are also grown on their own roots and on rough lemons.

Shaddock and Pompelmous.—Both these fruits are of little importance. As a rule they are grown from seed or by layering.

Nursery practice is much the same with citrus as it is with deciduous trees. The general principles are the same, but differences are to be observed in a few particulars. For instance, rather more water is needed, the buds are inserted in an inverted T-shaped cut instead of in the upright T-shaped one, the buds are thus to be pushed upwards instead of downwards, the object being to prevent the penetration of any moisture to the back of the bud in the shape of rain water; if this occurs the bud dies.

Bud wood should be selected with more than usual care from trees of well-known quality and bearing strain. In the case of Washington Navel buds very special care in bud selection is necessary. The marking of individual trees during fruiting time is imperative and should any one or two particular branches show fruit of very desirable qualities either as bearers or producers of extra fine fruit, these should be noted for future use.

The wood used in budding all citrus trees should be of the previous season's growth, round, and well matured and not sappy and triangular-shaped young wood, produced during the current season. In budding citrus trees, no matter of what kind, it is necessary to keep the bud sticks in a moist wrapper, an old sack will do, whilst carrying them round in the nursery prior to budding; the buds should be fresh and plump when inserted.

In planting out little trees from the seed bed to the nursery rows more room is required for citrus than for deciduous trees. The rows should stand fully 4 feet apart, some prefer 4 feet 6 inches, and the trees about 1 foot apart in the row. Staking each tree is a necessary feature in a citrus nursery, this is in order to ensure a straight stem and robust upright growth; as the young trees gain in height they should be tied to the stake at a distance of every 6 inches or so with raffia grass, not so tightly as to prevent the upward flow of sap in the tree. Apart from the items mentioned above, information *re* nursery may be obtained in the chapter on that subject.

Varieties of Oranges.—Although a fairly large number of different varieties of oranges are to be found in South Africa, the demand is at present almost exclusively confined to a few sorts which have

become favourites either from the aspect of fashion, profit or individual preference.

Without doubt, the fashionable orange is that which has fewest seeds and amongst the types which have some claim to be seedless the Washington Navel stands unique. A well-grown Washington Navel is hard to beat, both from the point of view of appearance, texture, flavour and seedlessness. The typical orange of this variety should be seedless; in shape round or very slightly oval. The rind should be smooth and medium fine in texture and of a full orange colour, averaging $\frac{3}{16}$ inch in thickness. The navel mark caused by the little orange contained at the apex of the fruit should not exceed $\frac{1}{2}$ inch in diameter—the smaller the better, as long as it is decidedly in evidence; the juice should be plentiful, with sweetness and acidity well blended and contained in juice sacs rather larger and longer than in the ordinary orange.

The tree is not of large dimensions as a rule, but such specimens are occasionally found.

The growth of a really first-class Washington Navel orange, both as to fruit and tree, calls for more care and better conditions than is the case with any other variety. It has been found that certain areas in the Eastern Province of the Cape and in the Transvaal are specially adapted by nature to the production of a really first-class Navel orange equal to the world's best. The soil, climate and conditions generally all appear to combine in the effort to produce an orange of superlative quality. To attempt to produce a good orange of this variety on poor soil is so much waste of time. The soil must be rich and deep, fertilisers must be carefully studied and applied. The irrigation and cultivation of the ground are imperative and shelter from high winds must be found. Given all these requirements the chances of producing a really good Washington Navel orange are favourable if one is careful to see *that trees of the right stamp are planted.* Nursery trees produced by the 100,000 may not always be grown from buds which have all been selected with the utmost care. Buds should be taken from trees of proved good-bearing habits which have produced regular crops of the best quality fruit having all the characteristics already mentioned. Unless these most necessary precautions are taken it is useless to expect to be able to produce fruit of good quality, and attention should be turned in some other direction. The Washington Navel is an early orange and commands the best prices obtained on the London market.

It is also true that trees of this variety bear a fruit which is more susceptible to some kinds of attack both from insect pests and plant diseases than others; still it maintains its hold on the popular fancy and in all probability will continue to do so.

Valencia Late comes next in favour after the above. In some quarters

it is held to be the best orange to grow in South Africa. It is considered more profitable than the Washington Navel, is a more regular bearer and so on that account more desirable. The trees attain a larger size than those of the navel type and the fruit is not as susceptible to the attacks of various pests. The fruit is somewhat oval in shape with but very few seeds, rarely more than six, sometimes none at all. The rind is smooth and thin, being often less than $\frac{3}{16}$ inch in thickness. The colour is full orange when ripe and covered with a slight whitish bloom. The Valencia Late orange ripens at various periods in the different provinces of the Union. It is often picked for shipment when fully coloured but unripe and sour to the taste. *Export of such fruit as this should be prohibited.* It may be gathered from the month of August until the following January, all depends on the locality. It has the peculiarity of reverting to its original green colour if not picked when properly matured. This is more marked inland than at the coast. Near Cape Town it will hang on the trees until February in some years without turning colour.

Du Roi is similar in type to the Valencia Late. The tree is equally vigorous in growth and the fruit also is somewhat similar. The variety is, however, distinct. The foliage is slightly different in colour, and the fruit is frequently borne both round and oval in shape on the same tree to a greater extent than happens with the Valencia Late. It has about the same number of seeds; the rind is of similar thickness but with less bloom on it and the colour is very slightly lighter. The fruit ripens a little—perhaps two weeks—before the Valencia Late and, like that variety, will revert to its green colour if not picked at maturity.

The Pineapple.—This variety is gaining in popularity and it is an orange of excellent quality. It was introduced by the Transvaal Agricultural Department in 1908. The fruit is as a rule quite round, but may and occasionally does vary from ovoid to rather flat. Seeds are plentiful. Rind smooth and of deep orange colour to reddish-orange inland, lighter at the coast. Juice is also plentiful in sacs smaller than usual. Ripens with the Washington Navel.

Mediterranean Sweet.—This is a very useful orange in that it is in season between Washington Navel and Valencia Late. It is of roundish shape, and the fruit is occasionally a little flattened at the apex end. Seeds are numerous and the rind is smooth and satiny. Colour is a mild rather than a deep orange and the fruit should be ripe and ready for export from July to September, depending on locality. The tree never grows to be large and has the smallest leaf of any orange. It is also thornless.

Jaffa is a round fruit with a moderate number of seeds, medium

size and deep rich colour. The rind is smooth but not as fine as the Mediterranean Sweet.

Joppa was raised from seed introduced from Palestine. Joppa came here, however, from California and is ovoid in shape with fewer seeds than most varieties. Rind is smooth, colour medium dark, juice plentiful and full orange flavoured. Ripens before Du Roi.

St. Michael's.—Called also Paper Rind St. Michael's, is an old favourite, having a reputation almost world-wide as one of the best oranges in cultivation. The fruit is of the best quality, with a number of seeds. Shape round. Rind of the thinnest. Deep orange colour with lots of juice in which sugar and acid are well blended. It ripens mid-season and is a high-class fruit. Neither fruit nor tree ever attains a large size.

Blood Orange.—There are numerous strains of these, owing to a multiplicity of seedlings having grown. Malta Blood is amongst the best known and can be taken as a good representative of the class. The trees are mostly small in size, bearing fruit which may run from slightly round to somewhat egg-shape. The rind is fairly smooth and deep reddish-orange in colour. It is frequently spongy in texture. Fruit is as a rule on the small side and when fully ripe is streaked with red outside and also the pulp, which is of superior quality with an unequalled flavour. Juice yellowish to red when quite ripe.

Bitter Seville.—" The Marmalade Orange," the hardiest of all orange trees and is to be found practically in a wild state in various parts of East Africa, where it was introduced by the Portuguese at a very remote date, probably early in the 16th century. The tree is a vigorous grower with leaves having a conspicuously large-winged petiole and numerous strong thorns. It assumes a distinctly different shape from trees of the sweet orange type, from which it is easily distinguishable. The fruit has numerous seeds, also distinct in shape, as they are flattened. The rind is coarse and dark orange in colour when fully ripe. The juice and pulp are acid and the rind is bitter to the taste. The best trees are propagated from seed, and this practice is commended for use in South Africa. The Seville comes true from seed. The blossoms are not liable to be crossed with pollen of any other variety. It will fruit in from five to seven years from seed. The advantage of a seedling Seville is that the fruit is of better quality than when budded on any other class of citrus. Budded on rough lemon stocks, the fruit is liable to become puffy, and on its own roots it appears sometimes to act as it does when used as a stock for any other kind of citrus in the Union, and will not produce as good a tree as a seedling. The Bitter Seville is the only orange which clarifies properly when made into marmalade and is valued accordingly.

The Lemon

The Lemon is sometimes spoken of as " The Poor Man's Friend "; the name has been applied because it is nearly always possible to go to a lemon orchard and gather a few boxes of fruit for market. The European type of lemon, which is the one now almost exclusively grown in the Union, is of comparatively recent introduction and was formerly called a " Lime " in South Africa. However, the correct name is now in general use. There are many types of lemons amongst the European varieties which embrace both sour and sweet kinds; the latter are not much in evidence.

The lemon should not be allowed to get ripe on the trees, " tree ripe " is the term used. The best prices are obtained for fruit uniform in size, colour and general appearance, and this is only to be obtained by picking the fruit as it attains a certain size. About $2\frac{1}{2}$ to $2\frac{3}{4}$ inches in diameter is considered suitable and the most acceptable for market purposes. Exact size is secured by putting all the fruit through a ring of the diameter selected. Quick " curing " to bring out the colour to the desired yellow stage is done by means of " sweating " in a room which can be rendered moist and warm as to atmosphere by some means or other, such as hot air or water pipes, an oil stove or any other practical method. The advantage of this method is that lemons can be prepared for a good market in a very short time—from one to two weeks. The drawback is that fruit so cured is less likely to carry well, should it be considered advisable to export it.

Varieties of Lemons principally grown in South Africa :

Eureka is one of the favourite kinds to plant. It is a seedling from California, where it is also in good repute. The only fault by any means common is that its foliage is apt to be scanty and so does not shelter the fruit from the sun on very hot days when sun-scald might occur. Pruning is a remedy for this and when properly carried out affords the necessary shelter. This variety is decidedly one of the best grown in the Union. It is of typical lemon shape, not too long nor yet too round in appearance, but something between a Lisbon and a Villa Franca.

The rind is smooth and clear lemon in colour and sweet to the taste. Juice plentiful and fully acid, seeds few, often none. The tree is rather on the small side, thornless or nearly so, with a tendency to tip bearing.

Villa Franca.—Probably more extensively grown in South Africa than any other variety. The fruit is larger and longer than Eureka and as free from seeds. Rind smooth and glossy, naturally rather thin, with no acidity, juice is abundant and fully acid. Seeds

frequently absent. The tree is a strong, vigorous grower and has the tip habit of bearing like the Eureka. Very few thorns.

Lisbon is also one of our leading varieties and has many friends. The fruit is shorter and rounder in shape than either Eureka or Villa Franca and has nearly always a distinguishing mark like a crease round the base of the nipple. Rind is thin and sweetish, juice plentiful and very acid, seeds few. The tree is one of the most vigorous growers, with plenty of foliage and also thorns.

The above three varieties embrace 95% of the different kinds of lemons planted in the Union. There are many others which may be seen described in the lists of our nurserymen, some of which may appear desirable, such as Imperial, Belair, Spanish, Sicily, Genoa, etc. In addition, there are the rough lemons, both sour and sweet; these are now, however, grown almost entirely for nursery purposes, but prove acceptable when choicer kinds are not available.

The Grape Fruit or Pomelo

The latter is the correct name of this fruit, but it has become so generally known as the "Grape Fruit" that there is little use in attempting to retain its proper name in anything but a botanical sense. It gained its present popular appellation on account of its habit of bearing fruit in bunches more or less like grapes.

The tree is a native of Malaya and was introduced into Florida by the Spaniards in the 16th century, according to Fraser's "American Fruits."

At present the demand for grape fruit is a growing one and as a consequence extensive plantings are now being made. The fashion of eating grape fruit, first developed in America, has spread thence to Europe and is also becoming popular in South Africa. It is considered an extremely wholesome fruit to eat and as a forerunner to breakfast is unequalled. It was first introduced into South Africa from Florida by the late Senator Sam Marks about 1892.

The choicest fruit of this class is grown here, as in other parts of the world, within the influence of the coastal atmosphere. Thus it may be stated at once that the grape fruit grown "up country" cannot compare with that produced in more suitable conditions. Covent Garden salesmen, who know the grape fruit business very thoroughly, state that amongst the finest quality of grape fruit sent to that market is that coming from Florida, Jamaica, Honduras and Cuba. The Californian article is ignored as far as quality is concerned, not being considered to be in the same class. Indeed it strongly resembles that grown in our own unsuitable areas.

A hot climate with a moist atmosphere and absolutely frostless

in winter suits that fruit admirably. There are possibly a few situations in what is termed the "low veld" of the Transvaal which are not near the coast, but which, owing to the climate found there, may be considered as nôt unsuitable for the production of a nice quality grape fruit.

With an increase in the number of varieties produced has come the period of distinct preferences amongst both growers and dealers for some particular type of fruit. Some prefer a fruit with plenty of seeds such as the "Triumph," whilst others like a seedless variety, like "Marsh's." Some growers confine their attention to one variety and advance many reasons for their preference; it is at least possible that at this early stage in the development of the grape fruit industry that a little prejudice exists. There is now not the slightest doubt but that this fruit has come to stay and its extensive culture may be regarded as certain. The most suitable climatic conditions have been indicated. Soils of a light sandy nature which might not be regarded as suitable for the orange will carry useful grape fruit trees; those of a heavier texture, including red loams, are also well calculated to produce a good tree. Heavy black loams are not as suitable, though much depends on the stocks used.

Copious irrigation is necessary both for the production of heavy crops of fruit and also the growth of the tree; from 60 to 80 inches of water per annum are not too much for this fruit.

The tree requires occasional attention in the matter of pruning. The fruit is often very large and heavy and being borne in clusters causes considerable sagging of the branches. This needs correcting by the removal of all low hanging limbs and the encouraging of the tree to form and maintain a compact head.

Varieties cultivated principally in the Union include:—

Triumph.—This is probably the most widely distributed variety in the country. Its principal supporters are to be found in the Transvaal, where the fruit does well when planted in suitable areas. The tree is an introduction from Florida, U.S.A., and is a strong, vigorous grower, especially on rough lemon stock. Fruit is large, averaging possibly 64 to the box, of excellent flavour combining bitterness, acidity and sweetness in a most attractive manner. Rind thin and dull pale yellow in colour. Seeds are numerous, juice is abundant and the fruit solid and heavy, which is a most desirable feature. The tree is a good and reliable bearer.

Marsh's Seedless.—This is the rival of the Triumph in popularity and is a favourite in the Cape. The tree is a good strong grower and regular bearer of a nice-sized fruit. The rind should be thin and of clear pale yellow colour. Seeds are sometimes absent entirely, but as many as eight are found. Juice is plentiful but has

not the flavour of those varieties which have seeds; nevertheless, on account of its being so nearly seedless, it is a favourite variety. The centre of the fruit may have a hollow space which tends to make it lighter than most sorts with seeds, and this is a drawback in the eyes of the dealer.

Ellen.—A variety introduced by Sir Percy Fitzpatrick from Florida recently. The fruit has proved an acceptable addition to our list of varieties. Size medium to large, of good quality and flavour, resembling " Triumph," seeds fairly numerous with abundant juice. Rind clear pale yellow with the most attractive appearance of any grape fruit in South Africa. It is a good solid fruit and fairly heavy. Likely to prove a favourite variety.

Walters.—This is another Floridan variety introduced by the Transvaal Agricultural Department and again by Sir Percy Fitzpatrick at a later date. The tree is a fair grower and a very heavy bearer of fair quality, medium to large-sized fruit. Flavour not considered as good as either Triumph or Ellen, but is acceptable to those who like a preponderance of the bitter taste. Rind fairly thick, smooth and of good colour, seeds numerous. The fruit is solid and heavy.

In addition to these there are other kinds of more or less interest. Pink-fleshed grape fruit are also to be had, but there is no market for them in London, where nearly all our fruit of this class goes, neither are they favourites locally.

A recent introduction is the Cicely, which originated as a sport from the Walters in Sir Percy Fitzpatrick's orchard. It is spoken highly of, but not enough is yet known of it to warrant unlimited planting.

The Naartje

The word " Naartje," as used in South Africa, covers all varieties of Mandarin and Tangerine orange of no matter what type. It is a distinctive South African word and owing to the continued export of the fruit to England is becoming recognised there also.

The growth and habits of the tree very closely resemble those of the sweet orange; soils suitable for the orange are equally well adapted to the naartje. Cultivation and irrigation practices are the same and the question of pruning runs along very much the same lines.

The naartje is the hardier tree, however, and when well grown on suitable stocks and under generally favourable conditions will reach a good old age. Instances are not uncommon of naartje trees living to be from seventy to eighty years old. It does best on its own roots; the sweet orange and sweet rough lemons also make acceptable stocks. *Citrus trifoliata*, when used as a stock, produces

a tree which may be somewhat slow in growing, but gives fruit of the very best type. There is no other stock which can compare with it as a producer of thin-skinned, juicy fruit. Naartjes grown on this stock invariably take first prizes at all shows.

There are many varieties of the naartje, embracing, as the word does, loose- and tight-skinned varieties of both tangerines and mandarins. Those most prominently before growers to-day will be found amongst the following:—

Beauty of Glen Retreat.—An Australian variety which has done well in South Africa. The tree is an enormous bearer and its branches are liable to break from overloading. The fruit is of medium size,

NAARTJE ORCHARD IN FULL BEARING. H. L. HALL & SONS, TOMANGO, TRANSVAAL.

solid, with few seeds and a beautifully thin, tough skin of a deep orange-red colour. It is of the tangerine type, flat with loose segments which separate very readily both from the skin and from each other. The flavour is of the best, and altogether this may be regarded as one of the most profitable varieties.

Natal Naartje.—This is also of the tangerine type and a favourite variety in Natal, where it does exceptionally well. The tree is a stronger grower than Beauty and though a good bearer is not as liable to overbearing. The fruit is larger, a little lighter in colour and the same shape. Skin tight with segments freely separating from it and an open centre. Seeds few, juice and pulp with rather more acidity than Beauty. Ripens June or July.

Cape Platskil.—This is the oldest type of naartje in South Africa

and with the Groenskil variety is supposed to have been amongst the very earliest introductions. It is of the tangerine class and a general favourite amongst the growers of the Western Province of the Cape. When well grown, and this is the rule there, it makes a very fine tree of good bearing habits. The fruit is perhaps not as attractive in appearance as those already mentioned, but it is of good flavour, with few seeds and plenty of juice. Segments part freely from the skin and also from each other and there is almost entire freedom from rag. Ripens July and August.

Cape Groenskil.—This is another old Cape variety. It belongs to the mandarin type. The principal difference between that and the tangerine is that of shape; in all other particulars the two are very similar. The tree is a strong grower, vigorous and very hardy. The fruit is roundish and flattened at the apex, and with a distinct neck at the stem end of the fruit. It may be eaten while still green, being quite sweet some time before the skin becomes yellow. The fruit is of good size and quality, solid, with abundant juice of good flavour. It is a tight skin variety, the rind being somewhat rough and indurated. The segments do not separate as readily as do those of most other varieties. The latest ripening naartje we have.

Bombay Naartje.—This is more of a favourite in Natal than in either of the other provinces. The tree is a fairly good grower and bears profusely. The fruit is the largest of the Naartje family and the least desirable, being loose-skinned and puffy. It possesses the one good feature of early ripening and on that account it continues to be propagated. The quality of the fruit is not first class, the flavour being somewhat watery, the segments are so loose that they will almost fall apart when the fruit is opened. Ripens May and June.

Besides these there are numbers of other naartjes with greater or lesser claims to attention. Amongst them is Merriman's Favourite, which is a smaller type of Natal; Cinnamon, which is a small, willow-leaved tree more of an ornamental than a commercial variety; Emperor Mandarin, a smaller type of Bombay, but shaped more after the mandarin style. There is also the Satsuma, which is thought a good deal of in some parts of America, but in South Africa is a second quality fruit; its sole claim to consideration is that it is very hardy and stands more cold than any other naartje.

The Citron

Very few Citrons are to be seen growing in South Africa. No question exists as to the suitability of many of our districts to produce a citron equal to any, but the demand has been and still is small. What little does exist is partly due to the development of the "Squash" industry. Makers of orange and lemon squashes turn

the rinds of the fruits they use into candied peel, and as the market for this article calls also for citron as well as orange and lemon peel, some small demand for the fruit has arisen.

There are but few orchards where the citron is more than a side line, but more trees have been planted within the last few years than for many years previously. We have but two varieties of citrons in South Africa and they are nameless; one type has a clear, smooth skin which lasts from the early stages of growth to the maturity of the fruit, and the other on commencing to turn yellow becomes corrugated in appearance, the corrugations running from end to end of the fruit.

The trees are always small and may be planted about 20 feet apart; they have the habit of blooming and bearing fruit almost at any time. The tree is more susceptible to frost than the orange. Propagation in South Africa is done mostly by layering, although the resulting trees do not make as good a growth, nor have they as good an appearance as when budded on rough lemon stock. The fruit is of clear lemon-yellow colour with very thick rind, which lends itself nicely to the production of a good candied article.

Pulp and juice are both scanty; an average-sized citron would be about 6 inches in length. The fruit bears some resemblance to the Spanish lemon, but is seen to be quite different on being opened.

The Lime

Very few Limes are grown in South Africa. The bulk of what trees we have are to be found in Natal, where there is a limited market for the fruit amongst the Indian community.

The lime has not been made use of in the Union for the production of either squash or the more celebrated product of Montserrat known as "Lime Juice Cordial"; however, this may come at a later date.

Varieties of limes include the Mexican, which is the smallest in cultivation and is largely grown in Mexico and to a lesser extent in parts of California. It is used there for the production of cool summer drinks and makes an "ade" preferred by many to that made from lemons. The author knew of a tree of Mexican limes which stood in an orchard at Warm Baths in the Transvaal, the fruit of which was one year sent to Johannesburg market, where it realised 1*s*. per 100.

The "Sweet Lime" and "Tahiti" are both to be found in Natal; the former may be eaten out of hand, but the latter is useless for that purpose, the juice being extremely acid. The lime makes a small tree and may be grown in almost any reasonably good orange soil.

The Kumquat

This, the smallest fruited member of the Citrus family, is a comparatively recent introduction into South Africa, the trees having been first introduced by the late Senator Sam Marks from Florida (where the fruit has been known since 1850) quite early in the present century. They were undoubtedly referred to by the Portuguese monks in 1569, in a report written by Father Monclaro, " as small oranges very yellow, which are eaten with the skin and yet are very sweet, but they are unhealthy," when he was describing what he had seen in Zanzibar. They do not appear to have been distributed from that quarter.

The fruit lends itself to the production of a very choice " konfyt " and is also preserved in other forms. It is an extremely pretty little specimen of the Citrus family and when trees are specially grown for the purpose, in small handsome teak tubs bound with brass rings or bands, it makes a somewhat unique addition to the dinner-table when placed thereon covered with ripe fruit, which is shown to great advantage against the dark green foliage. It is eaten with the skin. If required for such purposes as table decorations or ornamental lawn plants they are best worked on the *C. trifoliata* stock, as this has the effect of keeping the trees on the small side. They may also be winter pruned regularly with the same object in view.

If grown in orchard form, and there are very few instances in the Union of this practice, the kumquat may be budded on either sweet or rough lemon; the trees will then attain a height of some 12 feet or possibly a foot or two more, with corresponding girth.

There are only two varieties cultivated in South Africa: the *Nagami*, which is oval, and the *Marumi*, which is round in shape. The former makes the strongest growing tree as a rule. The fruit of the Nagami is between the size of a pigeon's egg and that of a small hen's egg, It is rather a dark orange colour and has an extremely thin skin. Seeds are always present but not numerous, from four to six being about the usual number. Ripens July to September.

Marumi.—The fruit of this variety is round and measures an inch or a little more in diameter on the average. The flavour is much the same as Nagami, and the skin equally thin, more seeds are to be found than in Nagami, but they rarely exceed eight in number. The tree has a similar habit of growth to Nagami, but has a few thorns.

The kumquats are heavy and regular bearers; the leaves of both varieties differ from other citrus fruits in that they have no gloss on them, are not as large and have serrated edges.

The Shaddock

The Shaddock is found all over South Africa where other kinds of citrus will grow. It appears in many of the gardens of the original settlers but never more than one or two trees were planted.

The shaddock and the grape fruit belong to the same family botanically, and it may be assumed as possible that the grape fruit is a descendant of the larger and coarser fruit by means of some kind of a "sport." The tree grows to a good size and has a handsome appearance. The fruit, of which there are two varieties, attains at times an enormous size and may occasionally weigh up to 18 lb. It is to be had either round or pear-shaped and with flesh of ordinary lemon colour or of a pink shade. We have no named varieties. Commercially the fruit has no value to speak of and is only used for the purpose of making "konfyt." The rind is very suitable for the purpose, being from 1 to $1\frac{1}{4}$ inches in thickness. The pulp is valueless.

The Pompelmous

This is an entirely distinct fruit from the shaddock, from which it differs in nearly every particular. In size the trees are about the same and may run to 35 or 40 feet in height with girth in proportion. The pompelmous is, like the shaddock, found principally in the gardens of the older population, who undoubtedly gave the fruit its present name.

The fruit is to be found in either pear or round shapes. The pulp is the same in either case and is lemon-yellow in colour with seeds in moderate numbers and a fair amount of juice. The fruit frequently has a hollow centre and the rind more the appearance of a rough lemon than anything else. It may measure anything up to 8 inches in length in the case of the pear-shaped and perhaps 6 inches in diameter in the round variety. The fruit has no commercial value, but the seeds are occasionally planted for the production of stocks for other classes of citrus.

Soils and Situations

Both oranges and naartjes thrive best on a deep, rich, loamy soil, the deeper it is the better they like it. Deep soils afford lots of room for root development and retain moisture to a far greater extent than do others of a shallow nature. Further, they act as reservoirs for the storage of plant foods on which the trees may draw for very long periods, for the orange is a long-lived tree and requires more in that way than can be supplied by shallow soils

unless frequent additions of fertilisers are made. The shallower the soil the quicker resort will be made to manures of one sort or another.

Some of the most suitable orange soils are to be found in the deep Karroo alluvial deposits, and the red sandy loams of the Transvaal, Eastern Province of the Cape and Natal.

Shallow soils and soils underlaid by pot-clay, hard pan, Oudklip or any other rocky formation should not be selected for the orange. The practice of blasting holes in unsuitable soil with dynamite has been advocated; this is a bad mistake to make, land of an undesirable nature is far better left alone. No soils should be used for an orange grove with a depth of less than 5 feet or with a water table within 4 feet of the surface of the land.

It is recognised that the very best conditions are not always easy to secure, but they are worth striving for and failure may be anticipated when such shallow and unsuitable soils as those described are unfortunately selected.

Situations for the planting of these two fruits should also be carefully studied. Next to the soil comes the water supply in point of importance, and then a position, which it is imperative, if the best results are to be obtained, should be sheltered from high winds and from anything in the way of hard frosts. The orange is a fairly hardy tree and will live through cold up to 12° to 14° Fahr., but such temperatures as those will not be good for the fruit, and therefore are out of court for commercial orange or naartje growing.

Trees exposed to seasonal winds which may blow for months from one quarter are liable to lose their proper shape and be blown over in the direction of such a wind; to grow, in fact, one-sided and to bear fruit only on the side which is not exposed to the wind. Such winds are common in South Africa during August and September and occasionally October. If no situations can be found with natural shelter from mountain or forest, then it becomes necessary to plant windbreaks of some quick-growing kind of tree in order that the necessary shelter be provided. If possible, windbreaks should be planted a year or two before the orange or naartje trees are set out.

Grape Fruit and Lemons are not quite as exacting in their demands on the soil. Many quite light sandy loams which may not be regarded as suitable for the orange are entirely acceptable as soils for both the lemon and grape fruit. The deeper these are, the better, for reasons already mentioned. Although lighter soils are in general use for both these fruits they will thrive on land of a heavier nature when such is to be found in a favourable situation. Soils with much clay are objectionable as also are what are known as " turf " soils.

It is fortunate that these two fruits are content with the lighter class of soil, because such is largely in evidence round the whole of our coast line from Durban to Cape Town in just those localities which are most highly approved of for the culture of both these fruits. Neither the grape fruit nor the lemon can put up with as much frost as can the orange and naartje, and as our coastal districts are frostless they are eminently suitable from that point of view.

Then, again, it is certain that the grape fruit in particular can only attain perfection in a climate which is warmer and moister than that to be found almost anywhere inland in South Africa with possibly one or two exceptions, where in the low veld a temperature is maintained and a humidity constant which much resembles what may be found at the coast.

Coastal grown grape fruit appears to develop the colour, flavour, rind and general appearance which go to the make up of a first-class article. Whilst the orange and naartje thrive best inland, exactly the opposite is the case with the grape fruit. The fact that a more even temperature with less difference between day and night registrations is to be had at the coast has much to do with the production of grape fruit of a high standard of quality.

Planting and Care of Citrus Orchards

Correct methods of the preparation of the land for planting citrus trees are more important than in the case of deciduous orchards. The fact that for the production of regular and good crops of fruit irrigation is imperative renders it necessary that the land should be so carefully levelled that the supply of water to each individual tree is assured. Too much care cannot be given to this important feature. The preparation of the soil itself cannot be too complete.

Actual planting methods are similar to those mentioned in Chapter VII. The distances at which the trees are planted vary somewhat according to the variety set out and also the class of the soil. The better the soil the larger the trees may be expected to grow. Trees of a naturally small habit of growth, such as Washington Navel and Mediterranean Sweet should not require more than 22 feet space between them, whilst stronger growing kinds such as Du Roi, Valencia Late, etc., want fully 25 feet. They may be planted either on the square, septuple or quincunx system just as other kinds of fruit trees are.

More care is required in handling young citrus trees at planting time than with deciduous fruits. The trees should be removed from the nursery and the roots at once packed either in damp moss,

leaves or soil. It is customary for nurserymen to pack orange trees in paraffin cases holding up to 15 to 20 trees, sometimes fewer; after becoming established they may be sent anywhere in the Union—if the journey is a long one, arrangements for watering *en route* should be made.

When packed in moss or leaves they are tightly wrapped in canvas; this method is less satisfactory than the other but is suitable when only a short journey is contemplated, sometimes the roots are puddled in mud before being packed in this way.

Balling trees before sending them away from the nursery is rarely practised in South Africa; many of our nursery soils do not lend themselves to the practice, being as a rule light and easily friable. For successful balling a heavier soil is necessary. The practice consists of a careful removal of each individual tree from the nursery rows so that as little soil as possible may be disturbed and its immediate wrapping in a square piece of canvas or sacking of appropriate size, the corners of which are drawn together and firmly fastened about the stem of the tree. Whatever method is adopted the roots of the trees should not be allowed to be exposed to the air or have any opportunity of drying out. The ordinary planting board may be used, though recently one has been introduced from California of rather a new type, having a wooden block 5 inches in diameter under each end of the board. This is meant to raise the level of the board to the correct height above the ground so that all the trees planted may stand at one uniform and correct height and well above the level of the soil. The idea is a perfectly sound one.

Watering at planting time, or rather immediately after the tree is planted, is of course necessary. The land should be maintained in a moist but not wet condition. The trees may or may not require to be cut back at planting. This depends on the condition in which they are received from the nurseryman. If they arrive in the form of one straight stem, then it is necessary to cut them back to one uniform height of about 22 inches. They may, however, come with the head of the tree already formed instead of being one single stem and have the three branches necessary to form the foundation for the future head of the tree already cut to the right length of about 9 or 10 inches. Should this not have been attended to, then the most suitable branches must be selected to remain and cut back to the desired length; all others should be cut off close up to the stem.

Protection of the trunks of the little trees from the hot afternoon sun may be provided by either whitewashing them or wrapping them with paper, or where no white ants are present good protection is afforded by tying long grass round them; this makes a

very effective shade, the only objection being that it might attract white ants.

The future care of the trees calls for the following operations: cultivation of the land, irrigation, fertilisation, possibly a little occasional pruning, together with such work in connection with the suppression of insect pests and plant diseases as may from time to time be necessary.

Cultivation. This covers all the tillage operations which are necessary for the upkeep of an orange grove. Summer rains prevail in most of our citrus areas and it follows therefore that growth, whether of weeds or cover crops during and shortly after that period, is rampant. When the rains are over the ploughs are put in and the crop, whether of weeds or legumes, is turned under.

During the dry season, the surface of the ground is kept loose for 3 or 4 inches by the use either of the cultivator or disc harrow. The tandem disc harrow is one of the best implements the citrus grower can use. A stirring of the soil once every three weeks or so is considered sufficient to maintain moisture near the surface of the ground and to do away with any stray weeds which may have appeared.

Work along these lines is termed "clean cultivation." It may be noted that it has the property of helping to fertilise the orchard by incorporation of weeds with the soil and so providing some small supply of humus and nitrogenous matter. When rains occur in the winter as in the Western Province of the Cape, the season's work is naturally reversed, and ploughing takes place late in the winter or early in the spring of the year. When weed growth is particularly rapid it may be necessary to plough two or three times in the season.

It will be seen therefore that cultivation means to a certain extent:—

1. The fertilising and aëration of the land.
2. The retention of moisture.
3. The orderly appearance of the orchard.
4. The prevention of erosion by allowing weeds to grow during the wet season of the year to be turned under later.

In addition it has been noticed by the author that young orchards in the areas of summer rainfalls, which have been kept clean and free from weeds or crops during the winter, have not suffered from frost when other orchards in some instances adjoining, where weed growth had been allowed to remain, instead of having been ploughed under at the right time, have been badly hit and experienced serious loss of trees.

5. Absolutely clean tilth—the entire absence of weeds or cover crop—exposes the soil to the danger of loss from washing way in

heavy rains. It adds nothing to the supply of plant food in the soil but decreases the organic matter and so causes loss of fertility.

Irrigation.—All citrus orchards should have proper irrigation facilities. No commercial success can be anticipated unless this is done.

There may be a very few exceptional cases where a certain amount of satisfaction has been obtained in growing oranges without the aid of irrigation, but they may be set aside as having no bearing on the matter from a general standpoint.

Water must be provided and in sufficient quantity to enable the roots of the trees to take up their nutriment in the ordinary manner, *i.e.*, in liquid form from the soil solution. Any increase or decrease in the water supply which materially interferes with the feeding functions of the roots reacts on the health of the trees, and evidences are very soon to be seen in the way of yellowing or curling leaves.

It is a mistake to attempt to plant orange trees on ground naturally wet with the idea that they will not require watering; such a proceeding is always followed by disaster. Wet ground is as objectionable to the orange as is dry. The secret of irrigating the orange for the production of large crops of sound fruit is to give a sufficiency of water at the right time so as to prevent the leaves ever getting to within a week of the time when they would begin to wilt. By wilting is meant that period when the leaves begin to show signs of curling up and showing their backs. It is claimed, when this practice is faithfully observed, that any serious annual drop of the Navel orange crop is discounted and much of the liability to produce fruit showing cracks in the rind is done away with. The actual time at which to give water with these objects in view must be discovered by each individual grower for himself, as owing to the wide difference existing between conditions of soils, drainage and sub-soils, apart from climatic aspects, no two orange orchards will have exactly the same requirements.

In the larger number of citrus orchards under summer rains it is estimated that a minimum of 40 inches of water should be sufficient to supply the needs of a tree in full bearing. Instances are on record where good crops of seedlings have been raised on half that quantity, but it is not safe to grow oranges on that basis; better have a supply too large than too small. Five or six irrigations should be sufficient to carry the trees on from the end of the last season's rainfall, which may be in February or in March, to the advent of those of the following season, commencing in September or October. The first watering after the close of the rainy season should be about a month after the last precipitation.

Five waterings, each of 3 acre inches, with a rainfall of 27 inches,

which in many parts is about an average fall, should be sufficient to maintain both trees and crops in a satisfactory manner.

The method of irrigation now in general use is that known as the furrow system. By its means a thorough soaking can be given to the whole of the orchard soil without allowing the water at any time to come in contact with the trunks of the trees. Formerly it was the custom to dig out a basin round the trunk of the tree and allow this to fill with water, letting it drain away and refilling the same basin again and again. This manner of irrigating orange trees has in the past taken heavy toll and caused the loss of more trees in South Africa than anything else.

A fall of 1 foot to 18 inches in 100 feet gives about the right gradient, and the water should flow along the furrows slowly, giving it plenty of time to soak in as deeply as possible. To this end, furrows should be made as deep as conveniently possible, either by means of a sub-soil following the ordinary plough when making the furrow, or, if such is not available, a second and smaller plough following the first; the object is to get the water deep down in the soil.

Furrows should never be longer than 100 yards; if of greater length than this it is quite likely that a portion of the trees will get far more than their share of water, whilst those at the further end will receive too little. Other particulars in connection with irrigation are to be found in the chapter dealing with that subject.

Fertilisers.—Amongst the most advanced growers of citrus fruits the practice of fertilising the orchard is now generally accepted as necessary to the well-being of the trees and the production of large and annual regular crops, as well as the maintenance of the soil in good workable and healthy condition. The best fruit comes from trees whose requirements have been studied and supplied by means of correct methods of fertilising with the most suitable agents.

It may here be stated that it is absolutely necessary that each individual grower should make himself conversant with the needs of his own trees and soils, watch the results of the application of each separate fertiliser and act in accordance with the experience thus gained. Scarcely any two orchards will be subject to *exactly* the same conditions, so that any statement made here must be regarded as general and not particular.

The needs of citrus trees include the use of all the component parts which go to make up what is known as a "complete" fertiliser. They comprise nitrogen, potash, phosphoric acid and lime. It does not follow that each and every one of these constituents must be applied at the same time, or that each is needed, as there may be an abundance of either one or the other of them in the soil which will render any further addition unnecessary. It

is desirable then that an analysis of the orchard soil should be made for guidance as to the work to be done in the way of future fertilising. In addition to Government institutions, there are many private chemical laboratories where such work can be done.

Nitrogen may be supplied by the use of cover crops, kraal manure, dried blood, stable manure, nitrate of soda and sulphate of ammonia. As practically 80% of the soils in our orange orchards lack humus, the growth of cover crops is extremely beneficial and should be resorted to as a regular annual affair.

The planting of such leguminous crops as cow peas, velvet beans, mung beans and sunn hemp early in the spring rains, and the turning of them under prior to the close of the rainy season, allowing a sufficiency of moisture in the soil for their speedy incorporation therein, supplies both nitrogen and humus in an acceptable and inexpensive form.

In poor light soils, it may be of advantage to give a dressing of 300 to 400 lb. per acre of some complete fertiliser so that a heavy growth of the cover crop may be assured. Any residue not absorbed by the crop would be available for the trees during the following season.

The addition of organic matter in the shape of stable manure has frequently been condemned by the author, chiefly owing to the practice of dumping it on the soil in a raw state, fresh from the stable and reeking with ammonia. Provided that stable manure is thoroughly well rotted it may safely be used in bulk, more especially on the older trees. Up to 10 tons per acre may be applied.

Kraal manure, which is entirely different, may also be freely used; such manures come as a rule from old sheep or cattle kraals and may in instances have been accumulating for fifty years or more; the benefit derived from these will depend to an extent on the area from which the supplies are drawn, the local "bush" and the manner in which the manure has been kept. Often the kraals lie open, exposed to all weathers for years, but as rainfall is as a rule light, not as much damage is done as might be thought. Up to 5 or 6 tons per acre can be used. If supplies of this material are available it is as well to get an analysis.

Poultry manure, although it is not of much consequence in very old orchards, is sometimes used round young orange trees. It is a highly nitrogenous manure and should be used with care; it is well to mix it with soil or ashes before applying it.

In addition to these organic nitrogenous suppliers, guano from the islands off the Cape is to be had, as well as bat guano, which is found in bulk in many parts of the Union. Neither of these has found favour amongst citrus growers. Dried blood is more satisfactory and its use is increasing. Commercial fertilisers mostly in

use as sources of nitrogen are sulphate of ammonia and nitrate of soda; both are expensive and act quickly. Results are apparent in the increased growth of the trees and the improved colour of the leaves, and often these features may be noticed within three weeks of the date of applying the manure. It is advisable to apply both these fertilisers with care, and not to use them at any time with others containing lime. For young orange trees which may require pushing along a little, the application of 1 lb. per tree should be ample. The material, which it is best to apply during the early growing season, should be scattered round the tree at least 15 inches from the stem to a distance of 36 inches and dug in. Older trees in full bearing may be given heavier doses, up to 500 lb. per acre may be applied, and it is best to scatter it broadcast amongst the trees and either disc or cultivate it in.

Potash plays a most important part in the chemistry both of the orange tree and fruit. The best oranges are those grown in soils in which there is no deficiency of potash or where, if not found, steps have been taken to supply the deficiency by the addition of that article in some acceptable form.

Commercially, potassic fertilisers are placed on our markets in the form of sulphate and muriate of potash; the former has proved the most suitable for general use in South Africa. For young trees 100 lb. per acre should be sufficient, but for old trees in full bearing up to 500 lb. per acre may be given. Other sources of potash may be found in wood ashes and burnt kraal manure, the latter proved most useful during the Great War, when no supplies of potash salts were to be had from Europe. Potash may be used in conjunction with lime and tends to the production of hard, firm wood. It promotes growth and also good bearing properties. It affects both the colour of the fruit, its flavour and aroma, besides helping to keep the skin thin, to diminish rag and to improve the pulp and quality of the orange generally.

Phosphatic fertilisers generally in use in South Africa embrace all kinds of preparations from bones, such as ground bones, in all degrees of fineness—the finer the bone is ground the more readily it becomes available; bone ash, dissolved bones and steamed ground bone; superphosphates and basic slag. Lately the use of basic slag has not been as general and more reliance has been placed on superphosphates and some one or other of the bone preparations; of these, steamed ground bone is the least desirable to use. It is hoped that rock phosphates of local origin will soon be available.

The function of phosphatic manures in relation to its effect on the trees is held to be that maturity of wood is hastened by its use. In citrus fruits it is found to be present in the pulp, rind and seed; an insufficient supply of phosphoric acid is said to delay the early ripening of fruit.

Assuming that the use of phosphatic manures has been decided on, the quantity to be applied will depend on the analysis of the material; with an average of 16% as much as 100 lb. per acre may be used for young trees and up to 300 lb. for older bearing ones. The absence of phosphoric acid is one of the most noticeable characteristics of our citrus soils, as also is that of lime. The latter may be applied as a rule quite freely up to 1000 lb. per acre, or more if necessary. Lime has a marked mechanical effect on most soils, rendering heavy and clay ones more friable and sandy ones less likely to be blown away. Apart from that aspect it has the effect of neutralising any tendency to acidity to which some of our south coast soils are liable. Further, it acts promptly and efficiently in liberating nitrogen from any humus the soil may contain and renders it available for plant food. Extra supplies of nitrogenous manures are better withheld when lime is being used, as too large an amount might be liberated. The use of commercial fertilisers is sometimes subjected to criticism. It has been stated recently that the use of all but those of a nitrogenous nature is largely waste of money. This is not the experience of the author; it is true that after the application of both potash and phosphatic manures little or no difference may be noticed at the end of the year in the appearance of the trees or the quality of the fruit; on the other hand, the effects of fertilisers which supply nitrogen are to be readily seen in far less time in the vigorous growth of the trees and the colour of the leaves. The continued application of fertilisers of both a potassic and phosphatic nature will, however, pay handsomely. The claims previously laid down will be justified and the use of both potassic and phosphatic manures will be demonstrated beyond doubt in the carrying qualities of the fruit.

Pruning and Working Over Varieties.—The orange requires less pruning than almost any other citrus tree.

Many of the old seedling trees have never had any attempt made at pruning them. They are naturally well-shaped trees, conforming very nearly to the orchardist's idea of what a well-grown orange tree should be as far as shape goes; there is frequently no necessity to prune the seedling orange.

Certain conditions may demand some attention with the pruning knife at the hands of the grower. The modern budded trees may need:—

1. The removal of suckers appearing either from the roots or trunk of the tree.
2. The removal of all twigs and branches which may have died from any cause.
3. The cutting out of all water sprouts and interfering branches and the thinning out of superfluous branches.

4. The removal of those ends of the branches which may sweep the ground so as to allow a space between the ground and the lowest branch.

5. The trimming up of trees which may have been subjected to constant winds from a certain quarter and have been so blown over as almost to denude the side exposed to the wind of leaves and bearing twigs, while the other side, not so exposed, has long straggling branches.

In regard to these it may be said that—

1. The removal of suckers is necessary because every one of them is a thief and robber, depriving the tree and its bearing brush and branches of a certain amount of nutriment. This work should be done two or three times if necessary during spring and early summer.

2. Cutting out dead twigs and branches is necessary to provide more space for those which remain, also because the dead portions may be the home of fungus spores and insect pests. The improved appearance of a tree after being treated in this way is worth all the time and trouble expended.

3. Water sprouts are the long, sappy, extremely vigorous growths which appear in the interior of the tree arising from one or other of the main branches. They are robbers and should be removed at the spot where they start. If allowed to remain, they do so at the expense of the fruiting brush of the tree. It is of rare occurrence for one of these growths to become of any use as a bearer of future fruiting brush, and even if it does, such fruit as it may carry is likely to be inferior. Water sprouts should be removed as soon as they are discovered. Branches which cross and rub each other should be dealt with by the removal of that which appears to be of the least importance. If both remain, probably neither will ever make a decent branch. Superfluous limbs should be cut out so as to allow of the free admission of light and air to the interior of the tree. The wall of foliage seen so frequently amongst old seedling groves gives a striking appearance to the outside of the tree, no matter under what conditions it may be seen, whether as a mass of green leaves or covered with blossoms or fruit. This is at the expense of the inside, which is deprived of both air and light and which it is impossible to reach with any spraying material, should it become necessary to spray the trees for any reason. An orange tree should have sufficient branches to enable it to carry heavy loads of fruit annually and they should be so spaced that one may be able to see well into the centre of the tree.

4. No branches should be allowed to sweep the ground. The fruit they carry comes into contact with the soil and gets rubbed so that the oil cells are all destroyed and the oranges get dirty and

unsaleable. Such fruit is of little value. When branches are allowed to remain touching the ground, the consequence is that the entrance of air and sunlight is precluded. Both are necessary to the well-being of the tree, the latter being the best preventative against bacterial troubles likely to attack either bark or roots. Attention to this matter should be given every other year.

5. Pruning the trees in order to enable them to return to something like their natural shape after having been laid over to one side by constant winds from one direction calls for rather more cutting away of branches than might at first appear necessary. This is the primary object to be attended to to enable the tree to offer less resistance to the wind, and is achieved by removing a number of branches, and thus allowing the wind a clear opening through which it may pass as against a thicket of branches, which would present far more resistance. Next comes the cutting of suitable branches on the exposed side fairly hard back in order to form a more vigorous growth in that direction and the removal of straggling ones on the sheltered side so that the tree may eventually regain its balance. This treatment, with the prompt planting of a windbreak if such a thing is possible, enables an ill-shaped tree to assume a more normal appearance.

The naartje tree may be treated precisely in the same way as the orange.

Pruning the Lemon.—The requirements of the lemon tree are entirely different from those of the orange and naartje in the matter of pruning. The habit of growth of the tree is at variance with that of the orange, the tendency being for the branches to become of a straggling, rambling nature. Many varieties if allowed to remain unpruned will persist in bearing on the ends of the branches, with the result that the weight of fruit causes them to bend over, exposing the fruit they carry, as well as that which is in the centre of the tree, to the danger of sun-scald.

It follows, therefore, that pruning the lemon has as a primary object the keeping of all growths within reasonable bounds. It is customary to head the lemon tree when planted at about the same height as the orange, perhaps a little higher, say about 26 inches. Branches proceed from the stem in much the same way and may be allowed to follow their own inclinations for the first couple of years, during which time they will put on quite a heavy growth.

At that period it becomes necessary to select those branches which are best placed for forming the foundation of the future head of the tree and reduce them to a reasonable height. These selected ones will form the main branches and by *annual* pruning may be so increased in numbers that in time they will form a tree of considerable size.

The annual pruning should consist of the selection of those branches which appear fittest to remain, the strongest, and those growing in the original direction taken by the main branches, being retained and those which are too thick and badly placed being cut away. This goes on during the earlier years of the life of the tree while growth is rampant. As it gets older, growth becomes slower and the annual pruning assumes lesser proportions.

During the forming of the framework of the tree the growth of fruit-bearing spurs or brush along the branches and in the centre of the tree must also be studied and controlled. There is a tendency to the formation of a thick centre and this should not be allowed. Sufficient space may be allotted for the production of a full crop of fruit without crowding the inside of the tree with too many twig growths. Like the orange in this respect, the lemon tree should always be in such a condition as will admit of anyone seeing well into the middle of the tree and allow the filtration of the rays of the sun through the branches to the ground.

The tree should be kept within bounds as regards height. Different ideas are held as to what is the best shape for a lemon tree to be trained to. It appears to the author that the open umbrella shape is the best; it maintains a comparatively low head combined with large bearing capacity and the fruit is well sheltered against hail and sun-scald. It is easy to train a tree to assume this shape. Stopping of erect growths in the centre of the tree and cutting to a lateral one growing in the desired direction have to be remembered and the rest follows.

The maintaining of a clear open space under the branches with none of them allowed to come nearer to the ground than 20 inches or so must be attended to. It may occasionally be necessary to spray the soil beneath the trees should some particular form of fungus unfortunately be present, and when branches are in the way this becomes difficult.

The lemon tree left to itself and entirely unpruned will continue to bear large crops for a number of years. The fruit is not, however, likely to be of a good type and will contain a large proportion of small fruit, unfit for sale except as culls. Judicious pruning puts a stop to that and by its use annual crops of good marketable fruit are secured.

The " open centre " system of pruning the lemon is not without its advocates. The same low head and widespread branches are secured as in the umbrella-shaped tree; the upright growths are eliminated and trained to the horizontal, which at once tends to increase fruit production. There is much to be said in favour of this system, but it does not provide shelter either from hail or sun-scald as does the other method.

Pruning Grape Fruit Trees.—There is not much difference between the pruning of the orange tree and the grape fruit.

Even greater precautions should be taken to keep both fruit and branches away from the ground. The fruits are borne in bunches, often at the ends of the limbs, and as they are very heavy, the branches have a strong tendency to sag downwards. This needs to be constantly watched and cutting back when pruning to an upward-growing lateral is often effective in correcting matters.

The trees should be kept well opened up to light and air, especial care being taken to cut out all dead twigs. A little attention in the way of pruning every year is likely to be followed by good results. Very large and heavy bunches of fruit should be thinned, so that each individual specimen may be enabled to develop properly.

This tree has a natural tendency to overbear, and one of the consequences is that years of heavy bearing alternate with others of scanty crops; this is more likely to happen as the trees get older. Judicious *annual* pruning and thinning of fruit should remedy this state of affairs.

Top Working Citrus Trees.—This becomes necessary sometimes from various causes. It may happen that a tree or trees have utterly failed in their first duty, *i.e.*, the bearing of good crops annually. The quality of the fruit may not have been up to the standard required. The market may demand some variety which is not in the orchard, or fashion may have set in with a run on some particular kind of fruit it is desired to produce, and one of the quickest, cheapest and easiest ways is to top work trees having a strong root system; this enables the new tops to develop rapidly and yield acceptable fruits of the sort wanted and at the same time to get rid of unprofitable kinds.

Top working by budding is now the only method practised. It is simple and easily acquired, and the only debatable point is to decide just by what method the work shall be done. Two different ways are open, the first requires the removal of the entire top of the existing trees and the insertion of new buds into the new growths which will soon appear, the second means budding into the old wood of the trees in suitable places before the removal of the top, then, as soon as the buds have " taken," all the branches are cut off a little above the bud.

Each of these methods means the removal of every branch from the old tree, leaving a bare trunk and shortened limbs, with no shelter from the sun. An alteration of a slight nature, the leaving of one branch on the western side of the tree, is supposed to be of benefit in two ways, by shading the trunk from the hot afternoon sun and by affording a means of absorbing the sap, which it is

claimed may be present in such quantities as to drown the buds by flooding. It will be seen that there are really but two methods to choose from, the leaving of the extra branch being entirely a matter of individual choice in either case.

The first-mentioned method is by far the most successful in South Africa. Recently it was stated by Dr. Webber that budding into the old bark was preferable. Some thirty years of practical experience in the Union have demonstrated to the author in a very clear manner that budding into the old wood is *not* as sound a system to follow here as that of budding into the new wood.

It is true that some slight delay occurs, but results by the latter method have proved generally more satisfactory, and the difference in the time required is so little that it is not worth considering.

The removal of the limb of the tree is best done with a sharp pruning saw (the Pacific saw is the best on the market). Those which are to be budded are to be placed some few inches apart and distributed well round the stem so that the new growths may eventually form a tree of symmetrical proportions. All the other branches are then cut off as close to the trunk of the tree as possible and the wounds painted or waxed over. The remaining branches are next cut off so as to leave a portion of about a foot or 18 inches in length, depending on the size of the tree. The cuts are painted over and the whole of the tree which is left is whitewashed in order to prevent damage to the exposed trunk and stubs from the hot sun. As the first growth of the season occurs in citrus trees towards the end of July, this work may be conveniently done during the month of June.

As spring advances, many new shoots start out from the branches which were left and these should be allowed to remain until a selection has been made of those best suited for budding on, then all the others may be gradually removed until none is left excepting those to be budded. They should be pinched back occasionally in order to make them stronger and to put on a stocky growth, and when the desired size has been reached, say $\frac{1}{2}$ inch in diameter, at about 6 inches from the base they may be budded in the ordinary way. It will be at once seen that this method must take longer than when buds are inserted in the old wood; time has to be allowed for the new shoots to reach the needed size, but the final results are more satisfactory.

Budding into the old wood is done in those branches which have been selected for the purpose before they are cut off. It is quite likely that in many cases the bark of these will be rather thick for budding into; this is remedied by scraping it down to a more suitable thickness at the point where the bud is to be inserted. Buds for this class of work should be on the large side, fresh and

healthy. As soon as they have " taken," the branches are cut off a little above the bud and the whole tree is whitewashed. With the growth of the buds a host of shoots will appear and these must all be rubbed off as they come so that the new buds may get what sap they require. Work of this type may be done in late February or September, the former being the time for dormant and the latter for spring budding.

Grafting the orange, or indeed any kind of citrus tree, is so little practised now as to be entirely negligible.

The Future of the South African Industry

The future of the orange industry depends on our ability to supply good fruit to those markets which are open to us. The primary consideration is good fruit, well packed, attractively displayed, at a reasonable price and in sound condition.

It may be said at once that South Africa *can* supply oranges of every type fully equal to those grown in Spain, Florida, California or any other citrus-producing country in the world. The conditions under which our oranges are grown are unique in that they afford everything necessary for the production of a really high-quality fruit. We can therefore rest assured that as long as we are able to offer oranges of this class the first steps are taken in the securing of a satisfactory market.

It is equally certain that if we are content to offer second-quality fruit we shall get second-class prices for it, and if any South African growers should be so foolish as to relax precautions and secure the export of hail-marked, scaly and unattractive oranges they will be doing an injury, not only to themselves (that would not matter so much), but also to the whole citrus industry of the Union.

We do not advertise sufficiently, and this should be attended to. We do not perpetually insist that our fruit is the best in the world, no matter where the next best comes from. We lack the effrontery to boast of our products and yet the author of these pages, during a long life largely spent in the fruit industry, has seen no better oranges than those grown in South Africa. Our fruits must be more widely advertised if we are to obtain wider distribution.

Our markets are confined to our own local ones, at present very limited, and those to be found overseas. Local consumption of oranges is of far greater dimensions than is realised by many, but it must increase considerably before it can make any appreciable inroad into the millions of boxes which we shall soon be exporting annually.

At present, our overseas market is England, which country has

in the past taken the whole of our export and will most likely continue to do so. The Continent of Europe has not hitherto taken many of our oranges, and those which have been sold there have not realised prices of a quite satisfactory nature yet; in time possibly Sweden, Holland, Belgium, France and Germany may become customers. India can take the fruit in fair quantities, provided cold storage in transport is supplied. The author has sent sample boxes occasionally and had reports of a favourable nature.

Canada should provide a market for a large quantity of our oranges; there is no reason why California should monopolise the whole of that market, and with the proper development of organisation it should be possible for South Africa to compete on terms not entirely of an unequal nature.

No market can be looked for in America, which country protects its own growers to the utmost, either by tariffs or restrictions of a nature which may or may not be necessary. Yet while the U.S.A. will always keep out our fruit on some pretext, that country regards South Africa as a milch cow for the makers of agricultural implements, motor cars and many other lines which we should either make ourselves or buy from those who support us. Take away the English market and where would our fruit be sold?

There appears to be no further outlet overseas for our orange crops. We can then look on

1. Our local market as existing.
2. English market as existing.
3. Canada market as possible.
4. Northern Europe market as possible.
5. Indian market as possible.

Of these it is necessary only to consider the English market at present. It is there that the immediate future lies.

The slogan "EAT MORE FRUIT" has been widely heralded in England and the results which have followed have been marvellous. As one isolated instance, it may be mentioned that the Great Western Railway at its London terminus (Paddington), through which station there pass 4,000,000 people annually, has started a stall for "Empire Fruit." This is an innovation which is being followed up at many other stations. It is a distinct and direct help to the fruit growers of South Africa and the Australian colonies; much of the fruit sold there is South African. There is no doubt but that the United Kingdom is doing its best to provide markets for our fruit. In 1924 England paid £48,000,000 for fruit imported from overseas; she would have preferred to spend the money within the Empire. Oranges and other citrus fruits came from

Spain, Palestine, South Africa, America and in lesser quantities from a few other countries. In the report of the Imperial Economic Committee published in 1926 it is stated that out of every 70 oranges eaten in England in 1924 57 came from Spain, 7 from Palestine, 3 from South Africa and 1 from the U.S.A.

Of the total sum of £48,000,000 paid out for fruit in that year, America and Spain took £20,000,000 between them, the former country supplying principally apples and the latter mostly oranges. The plunder was divided thus: America £11,000,000 and Spain £9,000,000. Our own export of fruit, including soft fruits, amounted to less than half a million pounds sterling, of which amount £270,000 was for citrus fruits.

Within a few years' time our export will have increased tenfold. We now have in the neighbourhood of 3,000,000 citrus trees growing in South Africa, principally oranges, and they may be expected to produce for export at the most moderate calculation an equal number of boxes of fruit. Can we depend on the United Kingdom to consume all of it? In 1924, the average consumption per head in England was 70 oranges—quite a fair number. The addition of another 3,000,000 boxes would entail the consumption of possibly another 50 oranges per head.

Two pertinent questions arise from that statement—Can England consume that number of oranges? and, if so, Can she pay for them? Both, in the opinion of the author, are possible—provided that true co-operation exists between South Africa as a member of the British Commonwealth of Nations and Great Britain as a partner in the same firm. More reciprocity must be practised and more money spent in Britain for such things as agricultural machinery, motor cars and the hundred and one other items which we now get from America. If this is done, it means that we help them to make a little money with which to pay us for our fruit, and from a purely selfish point of view it would pay South Africa in view of the development which must occur in its fruit industry, and especially that of the orange business, to foster imports from Britain, even if slightly higher prices were paid for the articles purchased.

The question of competition has not been mentioned, yet it must eventually occur. Oranges from Australia and South America will in time find their way to Covent Garden. Australians have already done a certain amount of business there and will do more. Californian Navel oranges are on the market in England during May and June always, and it goes without saying that they will lose no means of getting a foothold for other varieties to the detriment of South African fruit growers.

The lemon-growing industry does not rank in importance anywhere near that of the orange. No export of this fruit exists, and

in view of the low prices which Sicilian growers are content to take for their lemons it is unlikely that an export business of any magnitude will arise. Local markets and industries must continue to act as consumers of our products in that line.

Naartjes.—No extensive development is to be looked for in this direction. The fruit, although acceptable overseas, has not met with the reception it deserves as the choicest of all citrus fruits for eating out of hand. Planting may continue on a slightly increased scale, however.

Grape Fruit.—Prospects for an extensive development of the area under this fruit are decidedly promising. It has become a fashionable fruit in England and is recognised besides as having quite beneficial qualities from the point of view of health. It is quite true that a great deal of very poor quality grape fruit has been sent to England from South Africa, but it is equally true that, latterly, the quality has, generally speaking, much improved; this is due chiefly to the selection of suitable localities in which to prosecute development. At the same time, a local demand has sprung up which is likely to extend to fair dimensions. It is not to be expected that this fruit will ever approach the acreage devoted to the orange. Whether the European Continent may develop a taste for grape fruit which will be reflected in increased plantings here or not is not now possible to say, but the probabilities are highly in favour of it. The grape fruit is really suited to the taste of an epicure and should find a market in France and Germany. Our best specimens hold their own in competition with any from Florida and the West Indies, and if a closer study is made of localities in which to plant the tree, selecting those entirely frostless and with a moist, steamy atmosphere, there is every reason to suppose that South African grape fruit will become a popular article and one very much in demand.

CHAPTER XXX

THE EXPORT OF FRUIT

The export of fruit from the Cape to England commenced during the early nineties of the last century. The Rev. J. Legg of Stellenbosch has the credit of being the first to export a few boxes of peaches oversea with success. Very soon afterwards, Mr. Percy Molteno, Messrs. Malleson and Dicey and one or two more followed. To Messrs. Malleson and Dicey lies the credit of being the first to inaugurate an export business on anything like a commercial scale.

Grapes were sent from the Government wine farm at Constantia, during the time of Baron von Babo's stay there, by Mr. Kluge (now of De Aar), who was his assistant, about 1894. The fruit was placed in cork dust and packed in boxes. It arrived safely, but no immediate result was apparent.

The late Eustace Pillans, Horticultural Assistant at the Cape at the time, stated in his annual report that " English firms were inquiring for fruit " and again in 1895 he said that what little fruit did go to England was " not too good."

The greatest impetus was given to the fruit-growing industry in South Africa by the late Cecil John Rhodes when he bought numbers of farms on which the vines were dead or dying from *Phylloxera* in the neighbourhood of Paarl, Wellington, Stellenbosch and other parts of the Western Province, secured the services of Mr. H. E. V. Pickstone as general manager, temporarily, imported men from California with sound experience in the growing of fruit and planted a number of very large orchards.

The example set was followed at a later date by the more conservative element amongst the local farming community, when it was seen that there was " money in the business."

It is extremely interesting at this stage of the development of the industry, when it has attained its majority as far as years are concerned, to anyone who was present at the very beginning to look back and compare the early efforts of the pioneers and the let us say " scepticism " with which their efforts were regarded with the amazing imitation and adoption of the principles they enunciated at the commencement of their efforts to make a fruit country out of what had been purely a grape-growing and wine-producing one.

There is no object in following the different stages in the development of the industry from the early days to the present time, but

the inauguration of the orange export, successfully initiated in 1907, should be mentioned. Prior to that date the export of the orange commercially was unknown from South Africa. The stimulus in this instance came from the Royal Horticultural Society of England, when at a show inaugurated by them of citrus fruits in 1906 some eleven different colonies and dependencies were represented; a fine exhibit of South African citrus fruits was made and many prizes were awarded to oranges and other exhibits from this country, the

APPLES PACKED FOR EXPORT. MACCAUVLEI ORCHARDS.
[*Photo by E. Brandmuller.*

Transvaal taking premier honours, not only ranking above all the other colonies, but also above Natal and the Cape.

Commercial citrus export was from that time an assured thing. It commenced in 1907 and has made steady progress until to-day, when, instead of the modest 3000 cases dispatched in that year, the annual export is close on to 1,000,000 cases, and will soon be ten times that number. The importance of the citrus export business can hardly be over-estimated; it introduces a large amount of money from overseas and employs many thousands of helpers, white, black and coloured, all over the Union. It is far more widespread at present than the deciduous fruit export, which is very largely confined to the Western Province of the Cape.

Fruits exported at present comprise apples, apricots, cherries, peaches, nectarines, pears, plums, quinces, mangoes, paw-paws, pineapples, avocados, granadillas, pomegranates, persimmons, litchis, grapes, melons and strawberries.

All fruit exported is subject to certain regulations laid down by notices, which are from time to time published in the Government *Gazette*. These regulations are drawn up largely by the growers themselves, assisted by the various officials of the Agricultural Department. Slight changes may be made every year, but the broad principles are the same as those which have governed the business since the inspection of all fruit exported became, at the instigation of the author, compulsory in 1914. Prior to that date inspection at the ports had been on a voluntary system and notwithstanding that the Union Castle Steamship Company granted a preferential rate on all fruit which had passed the inspector, there were many who, for some reason or other, had not taken advantage of the concession.

It is the duty of all exporters of fruit of any kind to make themselves familiar with all Government Regulations.

Apple Export.—Apples have been exported in a sort of half-hearted manner for many years past. Recently with the extensive plantings which have been made in the Western Province, in the Orange Free State and Transvaal, greater interest has been shown, and a considerable number of apples have been sent away. The export in 1927 was 25,968 boxes.

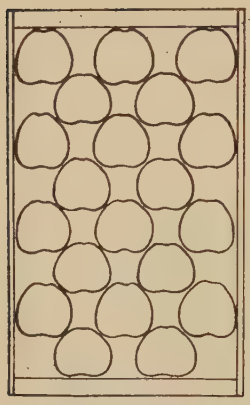
Apples are packed in boxes measuring $18 \times 11\frac{1}{2} \times 10\frac{1}{2}$ inches inside measurement. The shooks required for making them are as follows:—

Sides	4 pieces	$19\frac{1}{2} \times 5 \times \frac{5}{16}$ inches.
Tops and Bottoms	4 ,,	$19\frac{1}{2} \times 5\frac{1}{2} \times \frac{3}{16}$,,
Ends	2 ,,	$11\frac{1}{2} \times 10\frac{1}{2} \times \frac{3}{4}$,,
Cleats	2 ,,	$11 \times \frac{3}{4} \times \frac{3}{8}$,,

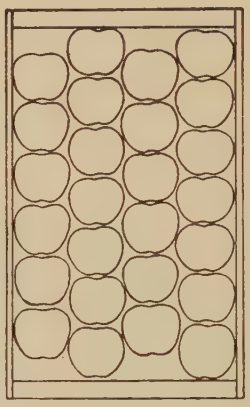
Each apple should be wrapped in paper bearing the brand or mark of the shipper. There is no need to use any corrugated paper as box lining, but boxes should be lined with paper with pretty lace edgings, so that when it is opened the box may have an attractive appearance. All must be marked in accordance with Government Regulations. Apples ripening prior to Ribston pippins should not be exported. This has been done on occasion against the considered advice of the Government Horticulturist, with results of a disastrous nature. The most popular export varieties at present are—

Commerce	Ohenimuri	Wemmer's Hoek
Delicious	Rokewood	White Winter Pearmain
Jonathan	Rome Beauty	York Imperial
Missouri Pippin	Statesman	Versfeld.

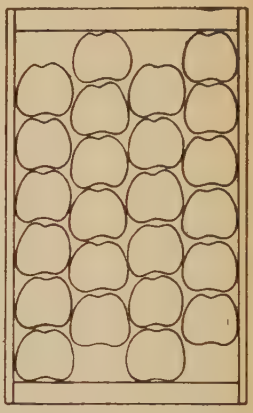
APPLE PACKS.



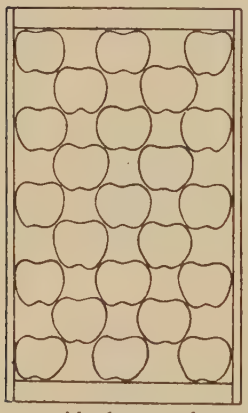
3–2 wide by 4–4 long; packs 100; 5 layers. Largest of the 3–2 packs; never used for flat apples. Each layer must be laid very loose.



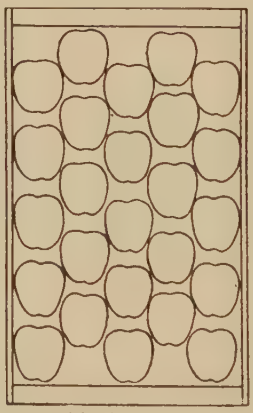
2–2 wide by 6–7 long; packs 104; 4 layers. Smallest practical size of the 2–2 packs, and can only be used with very flat apples, each layer drawn very tight.



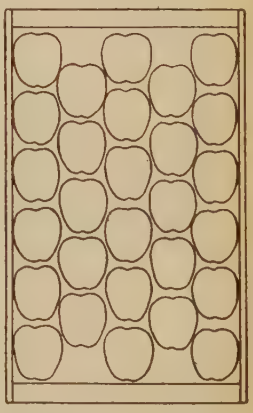
2–2 wide by 6–6 long; packs 96; 4 layers. Used for flat apples, but never for long, slim apples. Layers must be packed tight.



3–2 wide by 5–4 long; packs 115; 5 layers. The layers in this pack should be laid fairly loose.



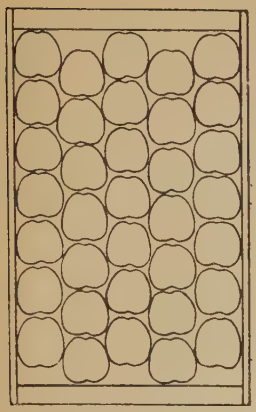
2–3 wide by 5–5 long; packs 125; 5 layers.



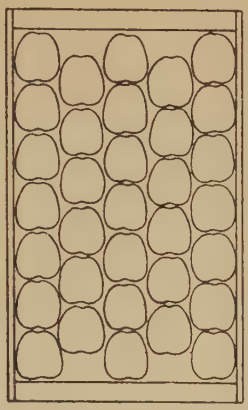
3–2½ wide by 6–5 long; packs 140; 5 layers.

Regulations in force at the time of writing state that Apples shall be packed in the box so as to contain the following standard counts:—

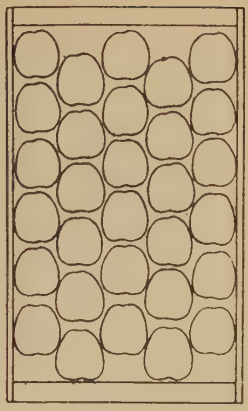
96	to	120	size . .	3	inches in diameter.	
125	,,	163	,, . .	2¾	,,	,,
175	,,	200	,, . .	2½	,,	,,
213	,,	225	,, . .	2¼	,,	,,



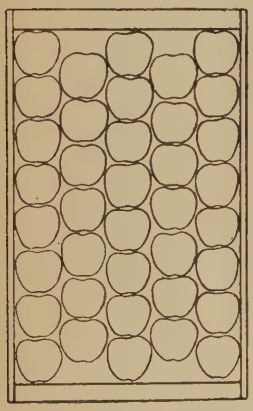
3–2 wide by 7–7 long; packs 175; 5 layers. The layers in pack must be snug.



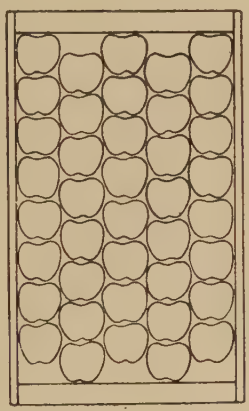
3–2 wide by 7–6 long; packs 165; 5 layers.



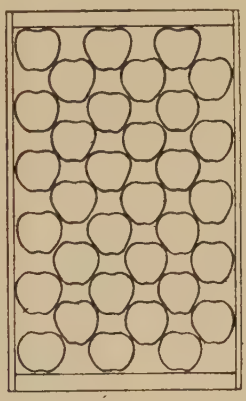
3–2 wide by 6–6 long; packs 150; 5 layers.



3–2 wide by 8–7 long; packs 190; 5 layers. Draw each layer in this pack very tight.



3–2 wide by 8–8 long; packs 200; 5 layers. The smallest practical size of the 3–2 packs. Layer must be very tight.



3–3 wide by 6–5 long; packs 198; 6 layers. Largest of the 3–3 packs. Each layer should be packed loose.

"Face packing," *i.e.*, the facing of a box with a couple of layers of fruit packed properly, with the balance "jumbled" in anyhow, is not allowed.

The apples should be packed in tiers either on the square or diagonal system. Of the two the latter is preferred and most generally in use, though for some shaped fruits the former may be more suitable. Flat-shaped apples require different packing methods

from long-shaped ones and they should not be mixed together in a box.

The diagonal packs shown are taken from the *Journal of the Department of Agriculture* of January 1925.

The 96 pack is two two by six six. Four layers.
The 112 pack is two two by seven seven. Four layers.
The 125 pack is three two by five five. Five layers.
The 165 pack is three two by seven six. Five layers.
The 175 pack is three two by seven seven. Five layers.
The 200 pack is three two by eight eight. Five layers.
In 1926 there were 15,416 boxes of apples exported.

Apricots cannot be said to be a favourite export fruit. The prices realised do not compare with those obtained for peaches and choice plums. Further, the demand is only a limited one and it is unwise to attempt to export any class of apricot which is not of good size, colour and appearance. Efforts to secure a market for apricots the size of marbles have been made by growers in the Transvaal during the last few years without much success, and it is to be hoped that they will not attempt further shipments of this class of fruit. No fruit business can be built up by the export of rubbish. Good apricots of the class mentioned will sell in limited quantities, but any attempt to export them on lines similar to those on which the peach and plum are exported would result in loss of money.

Apricots are packed in boxes measuring 18 × 12 inches outside measurement, depth being optional and depending on the size of the fruit. The boxes are lined and the fruit is packed in wood-wool, after being wrapped in paper which should bear the brand of the shipper. The fruit should be packed firmly and with a sufficient quantity of packing material to ensure its being properly carried, but without the slightest particle in excess of what is necessary. Buyers want to purchase fruit and not wood-wool. Any variety of apricot may be exported providing that it falls within the following, which are the Government regulation sizes and are termed:—

Variety.	Selected. Minimum diameter.	Choice. Minimum diameter.
Early Cape varieties and Royal . .	$1\frac{3}{4}$ inches	$1\frac{3}{8}$ inches
All other varieties	$1\frac{7}{8}$ „	$1\frac{3}{4}$ „

In 1926 the export of apricots was 4440 boxes.

The quantity of apricots exported in 1925 was 8295 boxes, and in 1927 10,701 boxes.

Cherries have only been exported in very small quantities hitherto. What business there is lies entirely in the hands of the growers of the Orange Free State and the Transvaal, and is likely to remain so for some time.

The fruit is packed in the ordinary 18 × 12-inch box and in the neighbourhood of 3 inches deep inside. No dimensions have been decided on for regulating the size of export cherries, but it is not likely that anything over $\frac{3}{4}$ to $\frac{7}{8}$ inch will be offered. Boxes should be lined with lace-edged paper and packed solid fruit throughout without any vestige of packing material. Cherries are packed one by one in rows straight across the box with suture side downwards (the suture is the faint line from the apex to the stem of the fruit); the boxes after filling are turned over and the top layer is seen to be the first one packed in the box.

The best varieties for export are to be found amongst the harder kinds of cherry such as those of the Bigarreau type, including Napoleon Bigarreau, Emperor Francis, Giant Heidelfinger, Monstreuse de Mezel.

Peaches.—The peach is one of the favourite fruits exported from the Union. Provided the correct varieties are selected, that they are picked in the right condition and secure proper treatment in transit, they are amongst the most profitable fruits we export and are particularly acceptable in England during those months when we are able to send them.

The demand there is for a white-fleshed peach, of round shape and with a good deep red coloured cheek. Free stone peaches are preferred to those with cling or half-cling stones. Providing that good fruit answering this description can be delivered in sound condition in Covent Garden Market, it can usually be depended on to realise from 7*s.* 6*d.* per box upwards, depending on the season of the year. For instance, boxes of 24 choice peaches have realised up to 60*s.* per box when arriving just in time for the Christmas market, whilst similar fruit, of equally good quality, might fetch 10*s.* per box in January or February. The smaller the fruit the lower is the price realised, although more than double the number of fruits may be contained in the box.

Yellow-fleshed peaches are not understood in England, they do not grow them there, and at one time our yellow-fleshed peaches fetched little or nothing on the market. Recently some demand has sprung up for a few Elbertas, and these are apparently appreciated. It is doubtful if a single specimen would sell with a cling stone.

A selection of the best varieties for export is as follows, and it may be said that there is still room for a really first-class white-fleshed late peach.

Earliest.—Inkoos. Mayflower. Le Vainquer.

Next earliest.—Waterloo. Early Alexander. Duchess of Cornwall. Duke of York.

Mid season.—High's early Canada. Pucelle de Malines. Peregrine. Crimson Galande. Dr. Hogg.

The attempt has been made to export very early peaches of Chinese strain, such as Jewel, Shackleford, Improved Peento and Waldo. These are grown in the warmer parts of the Transvaal and were introduced mostly by the author, for early local markets. They are entirely unsuitable for export purposes as even if they arrived in good order the flavour of this class of fruit is not what is called in England a real " peach " flavour.

Peaches are wrapped in paper and packed in boxes similar to those in which all our stone fruits are packed, *i.e.*, 18 × 12 inches, with the depth optional and depending on the size of the fruit. Wood-wool is used in all cases and it may be as well to add that this material should always be as white and clean as it is possible to get it. The practice of using wood-wool of different colours for packing is a mistake; apart from the danger of the colour being distributed amongst the fruit, should dampness arise or penetrate, it does not show up the contents of a box as well as the white does. The official sizes for export peaches are below:—

Variety.	Selected. Minimum diameter.	Choice. Minimum diameter
Elberta and Early Rivers . . .	2¼ inches	2⅛ inches.
All other white-fleshed peaches . .	2 ,,	1⅞ ,,

With reference to the " right condition " in which to pick and pack the peach for export, it is accepted as beyond dispute that all fruit must have developed full size, good colour and slight aroma, but must be gathered before it becomes soft in the slightest degree; if possible about two days before it would reach that stage. Peaches should be gathered in trays lined with wood-wool and conveyed to the packhouse without delay. There must be no pinching of the fruit to see just how ripe it is, and when picked it must not be pulled from the tree but taken off with a half twist, half pull.

Half-ripe peaches never develop the proper peach flavour. Peaches packed too near to the ripening stages will not " hold up " when the boxes are opened on the other side, consequently buyers are a little afraid of them. The correct moment to pick a peach can only be determined by personal practice.

The export of peaches in 1926 was 119,582 boxes, in 1925 225,037 boxes, and in 1927 379,539 boxes.

Nectarines.—These are highly thought of in England, and the demand for good fruit of this class is constant at good prices for the largest specimens we can send. The difficulty is to secure nectarines as large as the market asks for. Recently, prices for fruit of the finest quality and size have been better than those offered for peaches of similar sizes.

The fruit is packed and treated in precisely the same way as the peach. It should be gathered when fully sized and coloured and within a day or two of being ripe. The nectarine is a good shipping fruit and rarely arrives in anything but good condition.

Regulation sizes are as follows:—

Variety.	Selected. Minimum diameter.	Choice. Minimum diameter.
All varieties	$1\frac{7}{8}$ inches	$1\frac{3}{4}$ inches

The favourite export varieties are:—Goldmine, Cousa, Early Rivers, Stanwick.

The number of boxes of nectarines exported in 1925 was 15,241, and in 1927 30,676.

Pears.—Of all South African fruit, the pear takes first place in the list of exports. The flavour of the fruit, its excellent carrying qualities and the regular supply have tended to make these the most popular of all our deciduous fruits.

The export of pears takes place during the first four months of the year and it may be said that for, at any rate, three months, the South African pear is prominent on the London markets. It is by no means the only pear present. Australia is well represented, but it is no discredit to that country to say that their pears do not compare with those from South Africa, either in quality or in the way they appear on the markets. By far the larger portion of the pears we export are sent away in the ordinary single layer box. They are wrapped in paper bearing the shipper's brand and packed with a little wood-wool, but nothing like as much as is used for the peach and nectarine. Some of the smaller-sized fruits have recently been packed in larger boxes—in bulk—this is perfectly sound business and should tend materially to increase the pear export. In this pack each pear should be wrapped as usual, and the pack is quite easy, much easier than that of the apple.

The list of varieties suitable for export is a long one, too long in the opinion of some. Amongst them are recognised favourites and they constitute a very large proportion of the pears shipped.

Varieties like Clairgeau and Diel and a few others are only sent away in small numbers.

Pears for export require to be as carefully handled as peaches or any other fruit. The time for picking will vary considerably with the different varieties and must be studied. Bon Chretien, for instance, must be picked quite green, in fact as soon as it attains sufficient size: it is a beautiful pear, but if allowed to hang too long on the tree it is not likely to arrive in good condition.

As a rule, apart from this particular kind, most pears are fit for picking when the stems separate readily from the branch on which they grow, when lifted into the horizontal position from the vertical. A further guide is the colour of the pips: these should be just on the turn towards the brown colour which they assume when the fruit is ripe. The quantity of pears exported from South Africa in 1926 was 894,007 boxes and in 1927, a bad pear season, 358,134 boxes.

Regulations as to export sizes are as follows :—

Variety.	Selected. Minimum diameter.	Choice. Minimum diameter.
Bon Chrétien	2¼ inches	2 inches
Doyenné de Comice	2¼ ,,	2 ,,
Louis Bonne de Jersey	2 ,,	1⅞ ,,
Beurré Bosc	2¼ ,,	2 ,,
Winter Nelis	2¼ ,,	2 ,,
Beurré Hardy	2¼ ,,	2 ,,
Clapp's Favourite	2¼ ,,	2 ,,
D'Angoulême	2¾ ,,	2¼ ,,
Beurré Diel	2¼ ,,	2 ,,
Gansel's Bergamotte	2¼ ,,	2 ,,
Joséphine	2¼ ,,	2 ,,
Beurré Superfin	2¼ ,,	2 ,,
Flemish Beauty	2¼ ,,	2 ,,
Rustenburg	2¼ ,,	2 ,,
Magnate	2¼ ,,	2 ,,
Forelle	2¼ ,,	1⅞ ,,
Clairgeau	2¼ ,,	2 ,,
Durandeau	2¼ ,,	2 ,,
Keiffer	2¼ ,,	2 ,,
Packham's Triumph	2¼ ,,	2 ,,

Plums.—The Japanese varieties of plums and their hybrids have been favourites in the export fruit business both of the shipper, and the receiver on the other side. Their handsome appearance and general good carrying and keeping qualities make them profitable to handle. Whilst prices are not as high as for peaches and nectarines there is a steady demand at figures which are quite remunerative.

Originally confined in South Africa to a few leading kinds such as Kelsey, Satsuma, Burbank, Botan and Wickson, the addition of varieties introduced at a later date has created added interest to

this particular class of fruit. The red-fleshed plums are decidedly popular.

Plums are packed similarly to peaches and nectarines but with less wood-wool as the fruits are not quite as delicate, yet they must be carefully handled as the slightest bruise may cause discoloration. Boxes 18 × 12 × 3 inches deep more or less are principally used.

For plums which are now permitted to be shipped in bulk, such as Methley, Diamond and the French prune, no wrapping paper is needed and they may be packed in boxes 18 × 12 × 6 inches deep. The original package in which Japanese plums were exported from South Africa was termed " the half crate " and was a skeleton case holding four punnets each capable of containing 5 lb. of plums. This should never have been discarded.

Of the many kinds of plums exported, the popular varieties at present are Santa Rosa, Satsuma, Apple, Kelsey, Formosa, Gaviota and Beauty, the last named being one of the latest introductions. For export purposes plums should not be fully ripe, the formula " coloured but not ripe " expresses the condition in which they are best gathered. It is a mistake to send green plums away, they are not satisfactory from any point of view. When a plum has developed its full size and colour, it may be picked for export. The quantity of plums exported during 1926 was 100,558 boxes and in 1927 289,443 boxes.

Regulations as to sizes are as follows:—

Variety.	Selected. Minimum diameter.	Choice. Minimum diameter.
Satsuma	1¾ inches	1⅝ inches
Kelsey	2 ,,	1¾ ,,
Wickson	1⅞ ,,	1½ ,,
Apple	1¾ ,,	1⅝ ,,
Sultan	1¾ ,,	1⅝ ,,
Simoni	1⅞ ,,	1¾ ,,
Chalcot	1⅞ ,,	1¾ ,,
Burbank	2⅛ ,,	2 ,,
Santa Rosa	1⅝ ,,	1⅜ ,,
Formosa	1⅞ ,,	1¾ ,,
Gaviota	1⅞ ,,	1¾ ,,
Methley	1½ ,,	1¼ ,,
Beauty	1⅝ ,,	1⅜ ,,
October Purple	1⅝ ,,	1⅜ ,,
Queensland Golden	1⅝ ,,	1⅜ ,,
All other varieties of Japanese plums	1¾ ,,	1⅝ ,,
All varieties besides Japanese	1¼ ,,	1⅛ ,,

Quinces.—The export of quinces is almost a negligible quantity. Occasionally a few boxes are sent away and the prices obtained are moderately good, but not sufficiently so to induce further efforts.

Quinces when exported should be packed in the ordinary apple box. Grading for size by the eye is sufficiently correct. In 1927 330 boxes were exported.

Pomegranates.—There is a market at all times for a few boxes of pomegranates and those which we can and sometimes do send are very much better than those ordinarily to be seen on the Covent Garden Market. It is rarely, however, that consignments are dispatched. The number of trees in the Union is so small and they are so scattered that a consignment of 50 boxes would be hard to get together. The author has seen this fruit packed in boxes the size of an orange box on sale in London at good prices, and the fruit itself looked much more like balls of brown leather than anything else. They came from Spain. There is a market for up to 50 boxes weekly, and prices would be satisfactory. The beautiful carmine-red colour and general appearance of our fruit is alone sufficient to ensure its ready sale.

Persimmons.—Very few persimmons are to be found throughout the country. The sale for them locally is not extensive. Recently a few boxes have been exported. There is no reason why a larger number should not be dispatched every season, and an increased business developed. The fruit is not well known in England, but the best varieties are so strikingly handsome that they will sell on their appearance only. Local prices range from 4*s.* to 6*s.* per box of the usual size, *i.e.*, 18 × 12 inches, and it is probable that overseas buyers would be prepared to give the higher figure or more for good sound fruit.

Persimmons should be packed very carefully in wood-wool, as carefully as peaches are. The fruit should be picked when fully coloured, but not ripe, and wrapped in paper. Ordinary 18 × 12-inch boxes should be used. The best kinds for export are Hyakuma, Tane-Nashi and Yemon.

Mangos.—The first mangos were exported from the Transvaal in 1908. The fruit came from the Barberton and Nelspruit districts, and sold in London for an average price of 1*s.* each. The fruit arrived in good condition and was shipped from Cape Town with no special instructions for handling it otherwise than an export fruit usually is at that port. The following season further shipments were made which also realised good prices, as much as 10*d.* per fruit being obtained.

Later efforts were made to get the fruits down to the port in so-called refrigerator cars, but the venture was not successful owing to a lack of care in icing the car *en route*. Latterly mango export has lagged behind for some reason or other.

Now that refrigeration is really possible and there are far more mangos available than formerly, it would appear that the time is

ripe for the display of more energy in the business. The bulk of our export mangos is to be found in the East Transvaal and should Lourenço Marques be made a port of export for the Union, it would be wise to make use of that port for the business in mangos, as the distance is short. Night transport would do away with the necessity of refrigeration *en route* to the coast, and with immediate removal from the train to either the ship or cold storage which is even now available, the fruit could be placed in the temperature in which it was to make the oversea journey without the fluctuations which are so fatal to safe carriage. The right temperature for export mangos is 40° Fahr.

Mangos are wrapped in paper and packed in the ordinary 18 by 12-inch box. No grades are insisted on in regulations, but it will pay anyone exporting mangos (or any other fruit) to grade to size and colour as nearly as possible. A skilled packer will pack a box of mangos without any packing material in the shape of wood-wool, and, given fruit in first-class condition to export, they are better sent away without any packing. Wood-wool is, however, more frequently used than not.

The best variety of mangos for export are the Peach, H.L.H. and Sabre; all these sorts are of a very attractive appearance and good quality and will sell on sight. The "large green" mango, though equal in quality, is not such a favourite on account of its unattractive appearance. Prices should range about 15*s*. per box. During 1925, the export of mangos was 2495 boxes, in 1927 828 boxes.

Avocados.—The export of this most attractive fruit has not hitherto proved a success from South Africa. This is due to the fact that all attempts made so far have been undertaken with the wrong varieties. The author has seen lots of boxes of avocados opened at Covent Garden and rarely more than 5% of sound fruit.

Now that other kinds have been introduced into the Union of suitable nature for oversea transport, there is no doubt but that a successful export business will soon materialise. The principal difference between the old and the new type of avocado which we shall export lies in the skin or rind of the fruit. The skin of the old type is very thin and adheres closely to the fleshy part of the fruit. That of the new type is hard and tougher, and so prevents the bruising of the pulp. Really it is more like a shell than a skin. The newly-imported kinds are chiefly of Guatemalan and Mexican origin, and probably successful types will be found in Sharpless, Puebla, Trapp, Fuerte and Blakeman.

Packing should be in the 18 × 12-inch box with wood-wool; each fruit should be wrapped in paper. Tight packing is very necessary.

Granadillas.—There is always a market for a limited quantity of these, but large shipments are not recommended. Probably a couple of hundred boxes a week are what the market can absorb at present, but it is highly probable that the demand for this fruit will increase.

The only variety which we have successfully exported so far is the ordinary common granadilla. The larger kinds do not seem to have so good a flavour. Granadillas are packed in the ordinary 18 × 12-inch box, which should be lined with paper. The fruit is not wrapped, it is fit for shipment when fully coloured but before it begins to shrink and look wrinkled. In 1925 there were 790 boxes exported.

Litchis.—There are only a few litchi trees in the Union and these are mostly to be found in Natal and the Transvaal. Local demand is equal to the consumption of the entire product. The trees are only produced in a very limited way, so that any extensive immediate development in the way of exporting the litchi must not be expected. They are packed in the 18 × 12-inch box which should be paper lined, but no packing is needed. The fruits travel well and will last in a fruiterer's shop window for weeks without harm. Packing should be as tight as possible.

Pineapples.—This fruit has been exported from South Africa for a good many years now. Natal did the pioneer work, but more recently the bulk of the business had been done by the Lower Albany district of the Cape, where very large plantations are to be found belonging to the African Canning and Packing Co. As far back as 1912 the export of pineapples was 8000 boxes and nine-tenths of the output were of the Queen variety. The larger "Smooth Cayenne," although in many ways a more attractive fruit, is not such a favourite for export. Queen pines for export should be of a medium to large size, an average weight of about $1\frac{3}{4}$ lb. or up to 2 lb. should be aimed at. The fruit should be well coloured but not ripe, and with upright, well-shaped crowns; this last item is worth studying. None with double crowns should be sent away. The best months for the disposal of pines are June and July, when the winter crops should be maturing; shipments during January, February and March also meet with a good reception at fair prices.

Queen pines are packed in boxes of 27 × 14 inches of optional depth, with wood-wool as packing. Each box should contain a dozen fruits. Each fruit should be wrapped in paper if it is a specially good sample, otherwise a sheet of paper may be laid over the top layer after it has been packed, with a little wood-wool above that, and the lid nailed on.

For Queen pines, the standard orange box may also be used. The fruit usually runs to about 32 pines per box, *i.e.*, 16 each side of the centre piece. Smaller fruit is mostly sent this way.

The regulations with regard to the size of pineapples for export are as follows:—

Variety.	Extra selected.	Selected.	Choice.
Queen . .	Weight not under 1½ lb.	Weight not under 1¼ lb.	Weight under 1¼ lb.
Cayenne .	Weight not under 4 lb.	Weight not under 2½ lb.	Weight under 2½ lb.

Before packing, it has been the custom of some growers to allow Queen pines to stand upright on end or perhaps on a slant on the packing tables for a night, or possibly more, to allow of the draining and drying out of the juice from the stem of the fruit. Various methods have been tried to get rid of any moisture which may ooze out from the cut stem of the plant. The above appears to be equally as effective as other and more expensive methods.

It should be understood that, in picking pines for export, the stem is always left on the fruit, and according to regulations it must be ½ inch long in the Queen variety and 1 inch long in the Smooth Cayenne. When picking for the cannery, the pines are broken off short from the stem, the crowns cut off or pulled out, as the fruit, minus stem and crown, is all that is required.

Smooth Cayenne pines are sent away in boxes measuring 27 × 16 inches, depth being optional. The fruits are larger than the Queen variety and so a smaller number goes to the box, the exact count being, of course, determined by the size of the fruit.

This variety has not quite as good carrying qualities as the Queen, and more care should be taken in handling and packing. The draining through the stems will take longer and each pine should be wrapped separately in paper. Ordinary butter paper may be used. Pines from Florida, U.S.A., are seen in Covent Garden Market wrapped up in brown glazed paper. The fruit only is wrapped, the crowns being allowed to remain exposed.

The quantity of pineapples exported in 1925 was 61,666 boxes, valued at £13,855, and in 1927 55,511 boxes, valued at £9,748.

Grapes.—The grape has formed one of the most important features in fruit export ever since that business commenced. It has headed the list on many occasions and is likely to remain one of our leading export fruits as long as fruit is exported from South Africa.

The chief centres from which the grape has been exported lie in the immediate vicinity of Cape Town and include Constantia, Wynberg, Stellenbosch, Paarl and adjacent districts. Climatic conditions are very nearly perfect for the production of choice grapes, and these, associated with the knowledge, energy and

experience possessed by the generality of the growers, go far towards the production of the finest table grapes in the world.

The varieties grown have been collected at different times from the best vineyards of Europe, Asia and Northern Africa, and it would be hard indeed to find another spot on the earth's surface where such a marvellous collection of choice vines could be found. The utmost care is required in order to produce a perfect bunch of grapes suitable for the choicest export trade.

The vines must be trained, pruned and thinned so that the bunches may secure sufficient sun without getting an excess. During the period of growth and towards the close, when the berries distinctly show where they will be either too close together or too small on the bunches, thinning takes place, the small ones are cut away and the bunches thinned so that individual berries may attain their full dimensions without unduly pressing each other out of shape. Special "grape scissors" are to be had for the purpose. The operation is a tedious one, but the most profitable of all the various little jobs the grape grower is called upon to perform. A carefully thinned bunch of grapes with every berry perfect always catches the eye of a buyer.

Grapes are packed as a rule in boxes holding 10 lb. weight of fruit, it is well to pack overweight, as the fruit gets a little lighter as it sets out on its travels. Just how much overweight each grower must find out for himself, as this is a varying quantity. The boxes measure 18 × 12 inches, with depth as required. Government regulations on grape export state—

"The grades shall be

"1. 'Selected.' In this grade the bunches will be wrapped singly (*i.e.*, one bunch in each wrapper). The berries shall be of good and uniform size, and the bunches trimmed.

"2. 'Choice.' In this grade the bunches shall be trimmed and the berries a good size, but not falling in the preceding grade."

Unripe grapes will not be passed by the inspector. The grading of new varieties shall be left to the discretion of the inspector. It is recommended that grapes be cut and kept for at least twenty-four hours before packing, and that no grapes be exported on which rain has fallen within a reasonable time of picking.

To the above it may be added that it is not desirable to pick grapes for export at any time when the weather is foggy and misty.

The varieties regarded as the best for export may be found amongst the following :—

White Varieties.—White Hanepot, Rosaki, Raisin Blanc.

Red Varieties.—Red Hanepot, Molinera Gorda, Flame Tokay.

Purple and Black Varieties.—Hermitage, Barbarossa, Gros Colman, Gros Maroc, Gros Noir, Lady Downe's Seedling, Prune de Cazouls, Henab Turki.

Almeira.—This grape falls into another category. It may be packed with cork dust in bulk. Size of boxes is 18 × 12 × 6 inches. The quantity of grapes exported in 1925 was 331,831 boxes, valued at £94,301.

Melons.—" Winter Melons " are exported in small quantities. America was once a very good market, but since the import of all fruit of no matter what kind from South Africa into that country has been prohibited, that outlet no longer exists. They are sent away in either crates or boxes. The former measure $20\frac{3}{4} \times 14 \times 6\frac{7}{8}$ inches and are made from shooks of two pieces $20\frac{3}{4} \times 2\frac{7}{8}$ inches and three slats top and bottom $20\frac{3}{4} \times 2\frac{7}{8}$ inches, thickness of slats $\frac{1}{4}$ inch. The slats are nailed on about $1\frac{1}{4}$ inches from end and spaced evenly throughout make up of crates, *i.e.*, slats are placed $1\frac{1}{4}$ inches apart so as to allow a free air passage. Ends 12 × 6 × 1 inches.

Mr. H. O. Arton, of Drakenstein, has recently exported a larger class of melon introduced by the author. They are commonly called " Turkey " melons, having been brought from that country by Mr. G. Roeding, of Fresno, California, from whom seed was secured from South Africa. These melons are a large type of " Cantaloupe " and may vary in size from that of a large cocoanut to a very large football. The quality is unequalled. They arrive in England about April just before their hot-house melons are ripe and fetch good prices.

They are packed in the ordinary orange box, which may contain from two to eight specimens.

Strawberries.—Recently a small consignment of strawberries was sent to England more as an experiment than anything else. They arrived in a most satisfactory condition and were highly spoken of. It does not appear likely that a very large business will develop, but the fact that the fruit arrived in good order indicates the high state of efficiency to which the carrying of our fruit has arrived. They were packed in shallow trays 18 × 12 × 3 inches inside measurement, each tray containing six punnets of $5\frac{1}{2} \times 5\frac{1}{2} \times \frac{2}{3}$ inches. One particularly successful pack was 8 cartons in a tray, each containing a single layer of wrapped berries.

The Export of Citrus Fruits

The export of citrus fruits has attained large proportions since its inception in 1907 and that it will become far and away the most important branch of the South African fruit industry is beyond dispute.

A steady increase in the quantity sent away annually has taken place with but few fluctuations, and those principally during the Great War, and the time is not far distant when the number of boxes exported annually will be counted by the million instead of by the thousand as it is now.

The orange has been the one fruit to which most attention has been paid, but, in addition, large numbers of grape fruit and naartjes have been exported. The lemon has not figured to any extent in the list of exports and at present there is no indication that such will be the case.

With citrus export established on a fairly sound basis and prospects of extensive development, it has become necessary to provide the accommodation and machinery required for the proper handling of large crops of fruit. There are now numerous packhouses established throughout the Union, both on a co-operative basis and in private ownership. Their equipment has come from America chiefly, mostly from California, where the manufacture of orange-packing machinery has been brought to a fine art. Other machines have been introduced from Florida and Oregon, U.S.A., and also from Australia. South African makers are now also in the field, and it is hoped will be able to produce machinery equal to anything imported. More study should be given to this subject, as meanwhile other countries have been taking advantage of our neglect.

Oranges require to be handled with as much care as any other kind of fruit. No reason exists for treating them otherwise than most carefully simply because they have tough rinds. This very rind, when accidentally or carelessly punctured, is a prime cause of the admission of disease in the form of blue mould, and for this one reason only it is necessary that the hands of the pickers should be seen to, and the nails cut so that they may not make the slightest scratch on the skin of the fruit when handling it; cheap cotton gloves should be worn.

When the orange is cut from the tree it should not be in too green a stage; it is a mistake to rush unripe fruit on to the market with the idea that high prices will result. What happens is that fruit of good colour from some earlier district or country is there before yours and the green, unripe fruit gets a bad name, the shipper also gets a bad name and the country of its origin a black mark.

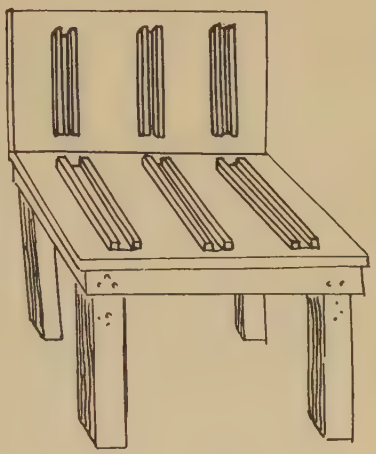
A standard of colour has been introduced and no orange with less than 70% is eligible for export.

In cutting oranges from the tree, the fruit is held in the left hand and cut away with the right; it may be cut clean off up to the button if conveniently placed, but it is safer to cut all oranges with an inch or so of stem left on, and then carefully to cut off the little bit remaining close to the button. The practice is more necessary in South Africa than elsewhere on account of the rougher labour employed.

Orange clippers, with rounded points so constructed as not to injure the fruit, are to be had from most hardware merchants. As

the fruit is gathered, it is placed in a suitable bag or tin bucket carried round the neck of the picker. This receptacle has a flap at the bottom which is opened when the bag is filled and the fruit is allowed to escape gently into the lug boxes, the end of the bag is placed in the box and withdrawn, leaving the fruit behind; in this way it gets no injury from falling or being dropped into a box. Lug boxes may be made from old paraffin or petrol cases with a little alteration, or proper ones purchased of a standard size, strong and well made, and that may, after all, be the best way to go to work.

When the lug boxes are full they are stacked one on the other in the shade of a tree until hauled away to the packhouse. In the boxes they undergo a wilting process and this may last for four or more days, sometimes less, all depends on the atmospheric conditions existing locally and the exact time must be decided by each individual shipper. During the process the skins become tougher and less liable to shrink after packing and the fruit carries better.



BOX-MAKING TABLE

It is an axiom that no oranges must be picked for export when wet or even damp. In the coastal districts picking should never commence in the morning before the sun has had time to clear off all signs of mist and dampness from the fruit.

Oranges are exported in boxes of one uniform size throughout; the measurements are 26 × 12 × 12 inches outside measurement, with centre piece also.

The shooks required are:—

Tops, bottoms and sides. . .	8 pieces	26 × $5\frac{1}{2}$ × $5\frac{1}{2}$ inches	× $\frac{1}{4}$ inch.
Middle and ends .	3 „	$11\frac{1}{2}$ × $11\frac{1}{2}$ × $\frac{11}{16}$	„
Cleats . . .	2 „	11 × $\frac{3}{8}$ × $\frac{3}{4}$	„

A box-making table should form one of the adjuncts to all packing houses when a machine is not employed for the purpose. It should be made of solid 2-inch planks something like the sketch, legs should also be stout and strong. Three pairs of inch-square deals should be run across from front to back of table forming grooves in which to place the middle and ends of the box standing upright; they

should fit into similar grooves at the upright back of the table, then the frame of the box is properly set and the sides and ends are quickly nailed on. The table should be about 40 inches long, giving room at one end for an enclosed space for nails; this is made by surrounding the space required with 1 × 1-inch deals, nailed on the table. Strapping is put on during the making up of the box. Box-making machines may also be purchased, but the price is high. Paper suitable for wrapping oranges is easily obtainable; the sizes required for the different packs are:—

For 96 pack	12 × 12 inches.
For 112, 125 and 150	10 × 12 „
For 176, 200	10 × 10 „
For 216, 252	9 × 9 „
For 288	9 × 8 „

Papers should be marked with the brand of the exporter and it is just as well to have a good paper, the brands always stand out better and clearer. In selecting a colour for printing the paper, avoid light and indistinct wishy-washy looking ones, rather select a bold dark blue, green, brown, purple or maroon, something which can easily be seen and recognised.

The model packhouses which are now to be frequently seen will be complete with all appliances in the way of sizing machines (called graders), brushers (to brush and clean the fruit before it leaves the machine), baths for washing, presses to press down the lids of the boxes while being nailed up, trucks to haul them away, paper-holders, box stands on which to place the boxes whilst being packed, in fact, all that is required for the complete and satisfactory packing of a box of oranges.

Unfortunately, these machines are not able to distinguish one orange from another and culling and sorting has to be done by hand. This work is really one of the things which should receive very close attention, as if fruit gets mixed it might mean a consignment being rejected at the docks. Sorting tables should be provided with all up-to-date graders; failing these, one should be improvised for the purpose.

Oranges of one type only should be sorted at one time. It is impossible to secure a "good pack" if oval and round types of fruit are put through the machine together. When packing a box of oranges, it must be borne in mind that the bottom layer is to be packed with the printed paper downwards and the twist pointed upwards; sometimes two layers are so placed, but that is not needed. Every fruit must be placed in the box properly, not thrown in, it must be firmly set in its right spot; in the diagrams shown there is a place for every orange, provided they are packed properly.

When the box is fully packed according to the diagram it will be seen that as the ends are brought down there must be a bulge in the centre of the case. This is as it should be, but if the fruit is firmly packed in, as it ought to be, this bulge will not be more than an inch or so in the middle of the box. A bulge of $1\frac{1}{2}$ inches is better than to have the lid set flat down on the box. Loose fruit never arrives in good condition.

Packed boxes of oranges must weigh fully up to the Government Regulations standard, *i.e.*, for packs of 112 and less the minimum weight is not under 72 lb., all counts over 112 must weigh at least 75 lb., and these weights might be increased with advantage.

Government Regulations admit of the export of very small fruit, going as many as 420 to the box and measuring under 2 inches in circumference. The author is unable to advise the export of anything smaller than the 288 pack, the size of which means an orange of $2\frac{3}{8}$ inches diameter.

Government grades are as follows:—

"Counts of	80	oranges per box, diameter is	$3\frac{1}{2}$	inches.
	96	" " "	$3\frac{3}{8}$	"
	112	" " "	$3\frac{1}{4}$	"
	126	" " "	$3\frac{1}{8}$	"
	150	" " "	3	"
	176	" " "	$2\frac{7}{8}$	"
	200	" " "	$2\frac{3}{4}$	"
	216	" " "	$2\frac{5}{8}$	"
	226	" " "	$2\frac{9}{16}$	"
	252	" " "	$2\frac{1}{2}$	"
	288	" " "	$2\frac{3}{8}$	"
	324	" " "	$2\frac{1}{4}$	"
	344	" " "	$2\frac{1}{8}$	"
	360	" " "	2	"
	420	" " "	$1\frac{7}{8}$	"

"Diagrams for packing are shown giving some of the most important counts. Very large fruits such as 80, 96 and 112 are not as much in demand as the smaller sizes, favourite and profitable sizes being 150 to 226.

"Grades for oranges are as follows:—

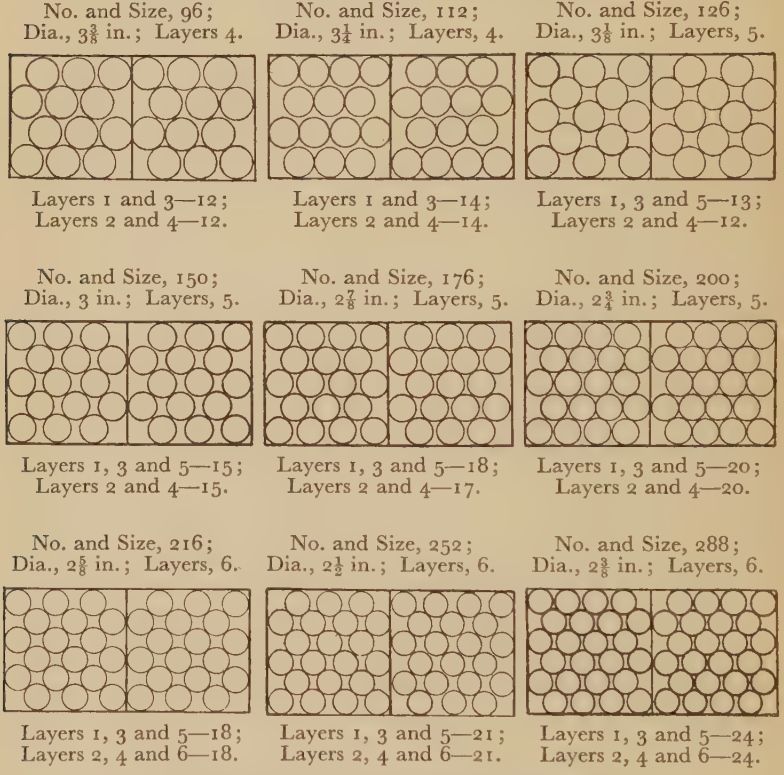
"'Fancy' includes fruit which must be free from all blemish or injury.

"'Choice' fruit must be sound in all respects, save for slight blemishes or other injuries, which in no way affect the quality of the fruit other than in its exterior appearance.

"'Standard' means that which is in all other respects equal to

'Choice,' but has been marked by hail or causes other than those specified in the following sections, but not to such an extent as to be unsightly, may be shipped, but the box shall not be marked 'Choice.'

"No fruit having scale or scale marks shall be exported, nor shall fruit having injuries of a fungoid or mechanical nature, likely


No. and Size, 96; Dia., 3⅜ in.; Layers 4.
No. and Size, 112; Dia., 3¼ in.; Layers, 4.
No. and Size, 126; Dia., 3⅛ in.; Layers, 5.
Layers 1 and 3—12; Layers 2 and 4—12.
Layers 1 and 3—14; Layers 2 and 4—14.
Layers 1, 3 and 5—13; Layers 2 and 4—12.
No. and Size, 150; Dia., 3 in.; Layers, 5.
No. and Size, 176; Dia., 2⅞ in.; Layers, 5.
No. and Size, 200; Dia., 2¾ in.; Layers, 5.
Layers 1, 3 and 5—15; Layers 2 and 4—15.
Layers 1, 3 and 5—18; Layers 2 and 4—17.
Layers 1, 3 and 5—20; Layers 2 and 4—20.
No. and Size, 216; Dia., 2⅝ in.; Layers, 6.
No. and Size, 252; Dia., 2½ in.; Layers, 6.
No. and Size, 288; Dia., 2⅜ in.; Layers, 6.
Layers 1, 3 and 5—18; Layers 2, 4 and 6—18.
Layers 1, 3 and 5—21; Layers 2, 4 and 6—21.
Layers 1, 3 and 5—24; Layers 2, 4 and 6—24.

SHOWING METHOD OF PACKING ORANGES

to cause waste, be exported. No oranges which have not attained 70% yellow or orange colour shall be exported."

The popular varieties for export are Washington Navel, Valencia Late, Du Roi, Pineapple, Mediterranean Sweet, Jaffa, St. Michaels, and Seedlings.

Grape Fruit.—This has become a popular fruit during the last few years, and the demand is an increasing one.

The manner of shipment is identical with that of the orange so

far as the size of the box is concerned. As, however, the fruits are very much larger, the numbers contained in each box differ very considerably. They are as follows:—

36	diameter	$4\frac{3}{8}$	inches	requires	paper	16 × 16	pack in	3	layers of	12 each
48	,,	$4\frac{1}{8}$	,,	,,	,,	16 × 16	,,	3	,,	16 ,,
54	,,	$3\frac{7}{8}$	,,	,,	,,	14 × 14	,,	3	,,	18 ,,
64	,,	$3\frac{5}{8}$	,,	,,	,,	14 × 14	,,	4	,,	16 ,,
80	,,	$3\frac{1}{2}$	,,	,,	,,	12 × 12	,,	4	,,	26 ,,
96	,,	$3\frac{3}{8}$	,,	,,	,,	12 × 12	,,	4	,,	24 ,,
126	,,	$3\frac{1}{8}$	,,	,,	,,	12 × 10	,,	5	,,	1, 3 & 5 of 13 each 2 & 4 of 12 each.

GRAPE FRUIT PACKS—FROM TEAGUE'S, SAN DIMAS, CALIFORNIA, CATALOGUE.

Government Regulations with regard to the export of grape fruit are as follows:—

"1. 'Fancy' fruit shall be that which is free from all blemish or injury.

"2. 'Choice' fruit shall be that which is sound in all respects save for slight blemishes or other injuries which in no way affect the quality of the fruit other than its exterior appearance.

"3. Fruit which is in all respects equal to 'Choice' but has been marked by hail or causes other than those specified in the following section, but not to such an extent as to be unsightly, may be shipped, but the box shall not be marked 'Choice,' but shall in place thereof bear the word 'Standard.'

"4. No fruit having scale or scale marks shall be exported, nor shall fruit having fungoid or mechanical injuries likely to cause waste be exported.

"5. No grape fruit which has not attained full development and colour typical of its variety shall be exported.

"6. The minimum weight shall not be less than 64 lb. for all counts up to 64, for counts above that number the minimum weight to be not less than 67 lb. per packed box.

"7. The size shall not determine the grade. No counts of more than 126 per box shall be exported."

In the opinion of the author the weights mentioned are entirely unsuitable, they admit of an inferior article being exported. This will be readily understood when it is pointed out that the following are the weights of grape fruit exported from Jamaica and other West Indian countries; the weights of Florida grape fruit are also given. The size of the boxes used in these countries may be a trifle larger in some instances, but in no case is it more than ½ inch deeper or longer than those in use in South Africa.

Weights of grape fruit boxes, as packed for the English markets in the following countries.

Jamaica. Counts of.	70	80	90	lb.
	80	81	83	
Porto Rico	82	83	84	
Indian River. Florida	87	89	89	
Ordinary Florida	83	85	88	

"All orange and grape fruit boxes shall be tightly packed throughout and the bulge in the centre after nailing up shall approximate 1 inch from the centre board."

Popular varieties for export are Triumph, Marsh's Seedless, Ellen, Walters. Grape fruits for export should be treated as are oranges prior to packing, wilting for about 4 days is necessary.

Naartjes.—Naartjes are divided into two classes, tight and loose skins. The former only are exported. They should be cut from the tree in the same way as oranges, graded for size by the eye or put through the sizing board, as no orange grader has yet been able to grade this fruit to give perfect satisfaction. They are then wrapped in paper and packed in boxes of the regulation size.

These are 18 × 12 inches, depth as required, or 26 × 12 inches, with depth optional, but not to exceed 6 inches, with a centre partition, the latter should be strapped. Inquiry for the sort of box most approved of for naartjes made at Covent Garden Market in August 1926 revealed the fact that dealers there prefer the 18 × 12-inch box with three layers of fruit. They claim that this is the most profitable package to handle and this statement was noticed to be perfectly sound.

Naartjes should be packed much as plums and peaches are,

with the exception that they do not need wood-wool between the fruit. Silvered paper, or even golden, is sometimes used for wrapping, but it is not necessary to go to this extra expense, as our naartjes are not on the market at Christmas time, when people in England are accustomed to seeing tangerines wrapped in this way.

Lemons.—The export of lemons is hardly worth mention at the present. Sample shipments in the past have not proved successful and it is doubtful whether prices realised overseas will ever tempt our growers to attempt to secure a footing in the European markets.

LEMON PACKS—FROM TEAGUE'S, SAN DIMAS, CALIFORNIA, CATALOGUE

No lemons should be exported unless properly cured prior to shipment. The demand is for a lemon with good, bright, clear lemon colour, thin, tough skin and plenty of juice. These qualities are obtained when lemons are properly cured. The favourite sizes are about $2\frac{1}{2}$ and $2\frac{3}{4}$ inches in diameter.

Curing for export should not be done by the application of extra heating, but by the slower process of the ordinary method. This means the securing of some enclosed space, whether room, tent or cellar does not matter, where the exact conditions for curing may be found or brought to bear. They are, first, a moderate temperature, secondly, good ventilation, and thirdly, the correct amount of moisture in the atmosphere. The fruit, allowed to remain in lug boxes, should be kept just so that no wilting shall take place, nor on the other hand, any sweating. Experience alone will tell the

grower exactly how to arrange matters for successful working in this direction.

Sizing lemons for packing is often done by hand, machine work is apt to be faulty, so sizing boards may be used. If lemons are picked with grading rings, little sizing is necessary. We have no standard lemon box, but the Californian size is here given, the measurements being 11 × 14½ × 27 inches outside, allowing for shooks of ¼ inch in thickness for tops, bottoms and sides and $\frac{1}{16}$-inch for middles and ends. Lemon packs as used there are as follows:—

210	. . .	diameter average	2¾ inches.
240	. . .	,, ,,	2⅝ ,,
270	. . .	,, ,,	2½ ,,
300	. . .	,, ,,	2⅜ ,,
360	. . .	,, ,,	2¼ ,,
420	. . .	,, ,,	2⅛ ,,
490	. . .	,, ,,	2 ,,
540	. . .	,, ,,	1⅞ ,,

Kumquats.—No kumquats have been exported as far as the author is aware up to the present. This pretty little citrus fruit is sure, however, of a market in England and it might well be exported in small boxes or trays. The package used in Florida, U.S.A., *i.e.*, a quart punnet, is very suitable and more compact than a tray package. The California half crate formerly in use in South Africa containing 4 punnets makes an ideal package for the kumquat.

Export of Citrus Fruits during season 1927.

Total number of boxes of citrus fruits exported was 838,703, made up of:—

Oranges	748,844
Grape Fruit	36,993
Naartjes	52,687
Lemons	179

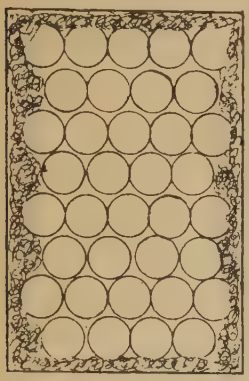
Fruit Packing Illustrations

These are taken from a bulletin issued by R. J. Bulmer, late Chief Fruit Inspector for the Union, who has been associated in South Africa with the author in the export and other branches of the fruit business for the last 30 years. Careful study of them will repay most growers. The term "Extra Selected" is retained to indicate the packing of the shorter counts.

Apricots

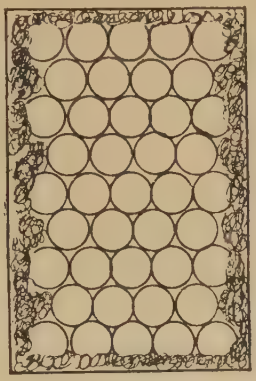
Extra selected, $1\frac{7}{8}$, 41 fruits, 9 rows 5 × 4; selected, $1\frac{3}{4}$, 45 fruits, 9 rows 5 × 5; choice, 50 fruits, 9 rows 6 × 5.

Extra Selected. Royal, etc.



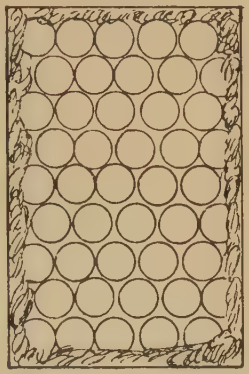
8–5 × 4 = 36.

Selected.



9–5 × 4 = 41.

Choice.

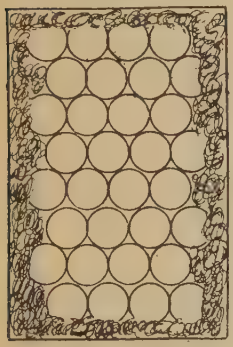


9–5 × 5 = 45.

Plums.

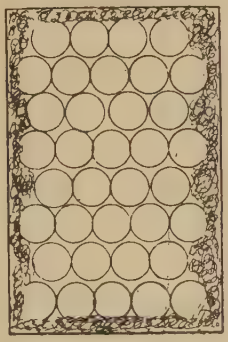
Wickson.—This plum should be packed in a firm condition when it is showing yellow to pink at the point. On no account should it be packed after it has become red. Pack it in the following

Extra Selected.
(1) Wickson.



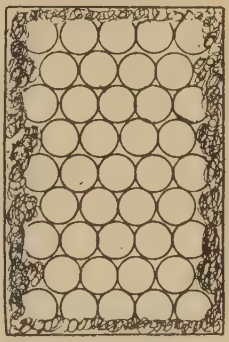
8 4 × 4 = 32.

Selected.



8–5 × 4 = 36.

Choice.

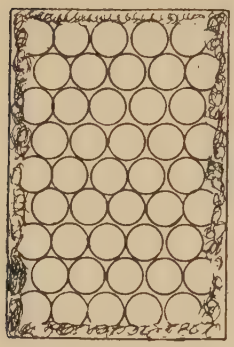


9–5 × 4 = 41.

manner:—Extra selected, $2\frac{1}{2}$, 32 fruits, 8 rows 4 × 4; selected, $2\frac{1}{8}$, 36 fruits, 8 rows 5 × 4; choice, 2, 41 fruits, 9 rows, 5 × 4.

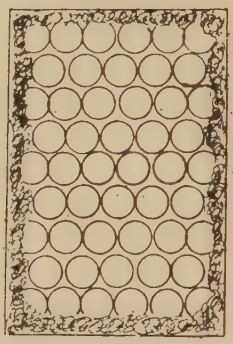
Santa Rosa and Beauty.—These two varieties should be packed: (*a*) Santa Rosa when fully coloured, and (*b*) Beauty when it is firm and just amber-coloured. The packing for both should be in the

Extra Selected.
Santa Rosa Beauty.



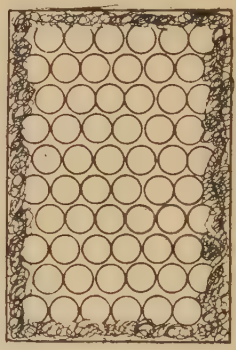
9–5 × 5 = 45.

Selected.



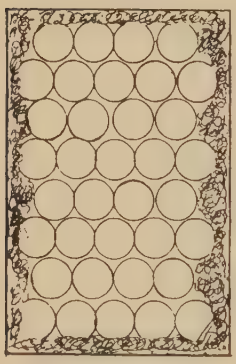
9–6 × 5 = 50.

Choice.



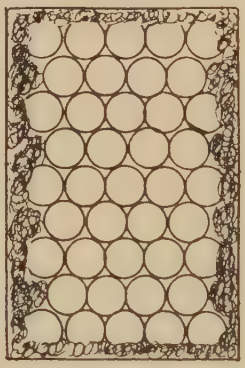
10–6 × 6 = 60.

Extra Selected.
Satsuma.



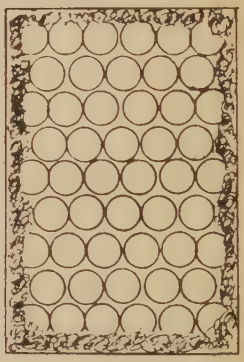
8–5 × 4 = 36.

Selected.



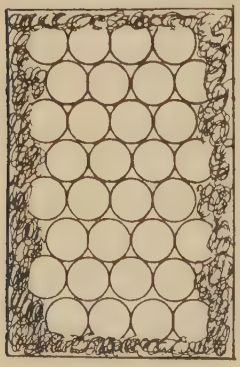
9–5 × 4 = 41.

Choice.



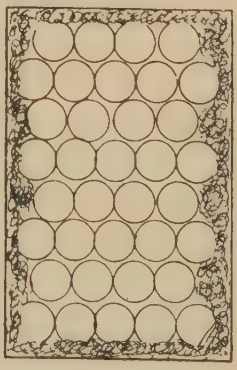
9–6 × 5 = 50.

Extra Selected.
Kelseys.



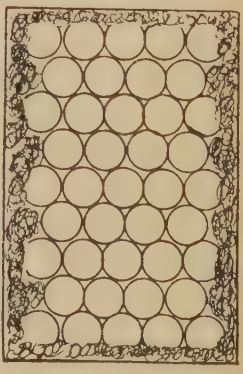
8–4 × 4 = 32.

Selected.



8–5 × 4 = 36.

Choice.



9–5× 4 = 41.

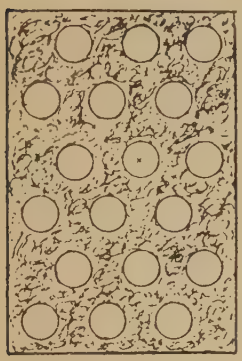
following manner:—Extra selected, $1\frac{7}{8}$, 45 fruits, 9 rows 5×5; selected, $1\frac{3}{4}$, 50 fruits, 9 rows 6×5; choice $1\frac{5}{8}$, 60 fruits, 10 rows, 6×6.

Satsuma should be packed as follows:—Extra selected $2\frac{1}{8}$, 36 fruits, 8 rows 5×4; selected, 2, 41 fruits, 9 rows 5×4; choice $1\frac{3}{4}$, 50 fruits, 9 rows 6×5. In "choice" grade, larger fruits should be packed 45 fruits, 9 rows 5×5.

Kelseys.—Should be packed when they show colour, as follows:—Extra selected, $2\frac{1}{4}$, 32 fruits, 8 rows 4×4; selected, $2\frac{1}{8}$, 36 fruits, 8 rows 5×4; choice, 41 fruits, 9 rows 5×4.

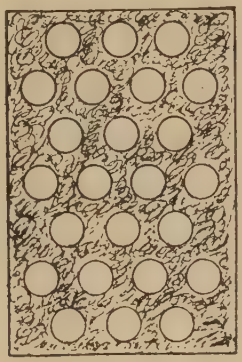
Peaches should be packed when fully coloured but not quite ripe.

Extra Selected. Inkoos, Early Alexander, etc.



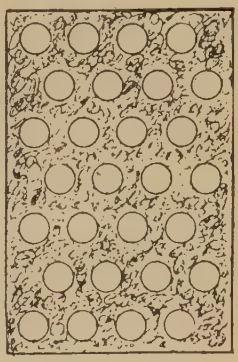
6 $3 \times 3 = 18$.

Selected.



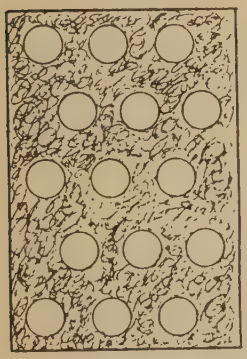
7–3 $\times 4 = 24$.

Choice.



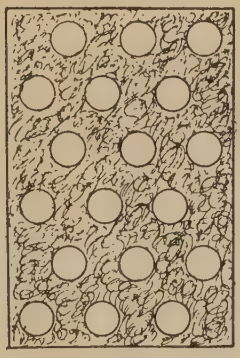
7–4 $\times 4 = 28$.

Extra Selected. Elberta.



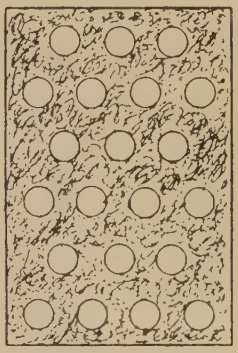
5–3 $\times 3 = 15$.

Selected.



6 -3 $\times 3 = 18$.

Choice.



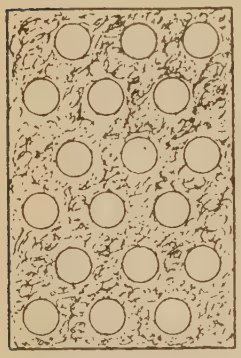
6–4 $\times 3 = 21$.

Elberta should be packed:—Extra selected, $2\frac{3}{4}$, 15 fruits, 5 rows 3×3; selected, $2\frac{1}{2}$, 18 fruits, 6 rows 3×3; choice, $2\frac{1}{4}$, 21 fruits, 6 rows 4×3.

Nectarines.

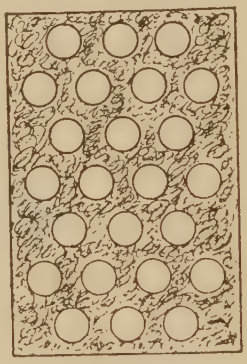
The following varieties are recommended:—Early Rivers, Stanwick, Victoria, Albert Dryden, Newton, Goldmine, De Cousa. All varieties should be packed with wood-wool between fruits and, with the exception of Goldmine, as follows:—Extra selected, $2\frac{1}{4}$, 18 fruits, 6 rows 3 × 3; selected $2\frac{1}{8}$, 24 fruits, 7 rows 4 × 3; choice, $1\frac{7}{8}$, 32 fruits, 8 rows 4 × 4. In the "choice" grade, larger fruits should be packed 28 fruits, 7 rows 4 × 4.

Extra Selected.
Early Rivers,
Stanwick, etc.



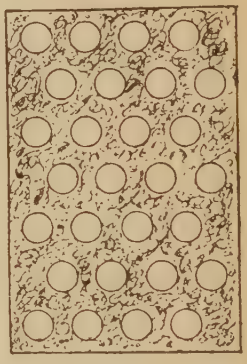
6 4 × 3 = 18.

Selected.



7-4 × 3 = 24.

Choice.

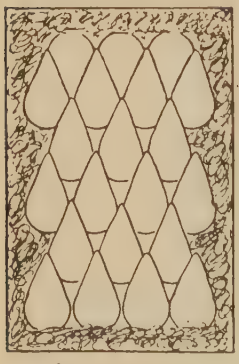


8-4 × 4 = 32.

Pears.

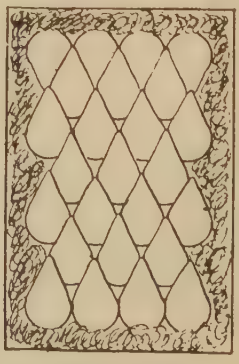
All pears should be packed when fully developed.

Extra Selected.
Bon Chrétien, etc.



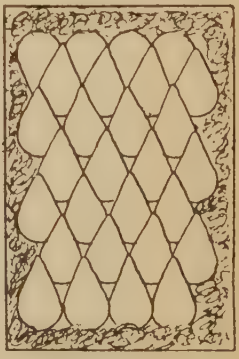
6-4 × 3 = 21.

Selected.



7-4 × 3 = 25.

Choice.



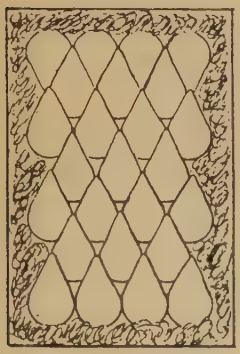
7-4 × 4 = 28.

In regard to other varieties the following pack is recommended:—

Comice and Glout Morceau.—Extra selected, 3, 18 fruits, 6 rows 3 × 3; selected, $2\frac{3}{4}$, 21 fruits, 6 rows 4 × 3; choice, $2\frac{1}{2}$, 25 fruits, 7 rows 4 × 3.

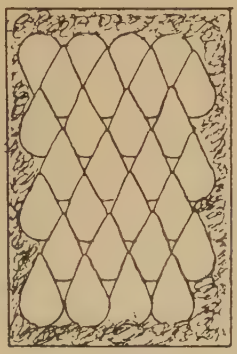
Louise Bonne, Forelle.—Extra selected, $2\frac{1}{2}$, 25 fruits, 7 rows 4 × 3; selected, $2\frac{1}{4}$, 28 fruits, 7 rows 4 × 4; choice, 2, 36 fruits, 8 rows 5 × 5. In "choice" grade, the larger fruits should be packed 32 fruits, 8 rows 4 × 4.

Extra Selected.
Louise Bonne, etc.



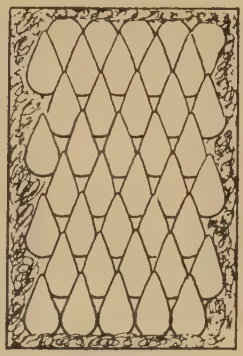
7–4 × 3 = 25.

Selected.



7–4 × 4 = 28.

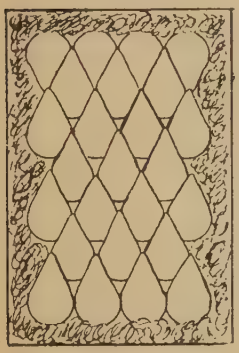
Choice.



8–5 × 5 = 40.

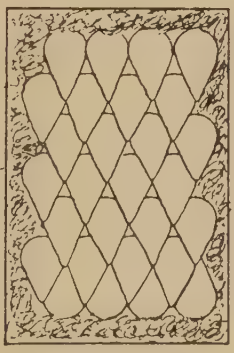
Winter Nelis and Josephine.—Extra selected, $2\frac{3}{4}$, 25 fruits, 7 rows 4 × 3; selected, $2\frac{1}{2}$, 28 fruits, 7 rows, 4 × 4; choice, $2\frac{1}{4}$, 32 fruits, 8 rows 4 × 4.

Extra Selected.
Winter Nelis and
Josephine.



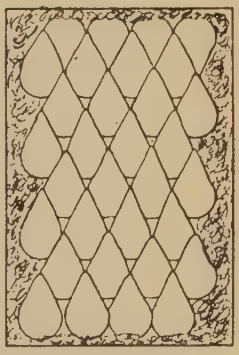
7–4 × 3 = 25.

Selected.



7–4 × 4 = 28.

Choice.

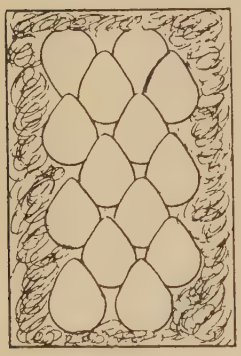


8–4 × 4 = 32.

Keiffer.—Extra selected, $3\frac{1}{2}$, 14 fruits, 7 rows 2 × 2; selected, $3\frac{1}{4}$, 18 fruits, 6 rows 3 × 3; choice, $2\frac{3}{4}$, 25 fruits, 7 rows 4 × 3. In "selected" grade, larger fruits should be packed 15 fruits, 6 rows 3 × 2, and "choice," 21 fruits, 6 rows 4 × 3.

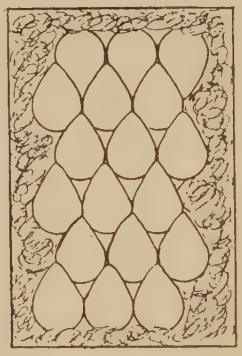
In all the hardier varieties of pears, packing of the smaller grades in bulk in standard export apple boxes is recommended and the fruit should be packed in the standard apple packs, no wood-wool whatever being required. This pack is not recommended for Bon Chrétiens or Clapp's Favourite.

Extra Selected.
(3) Keiffer.



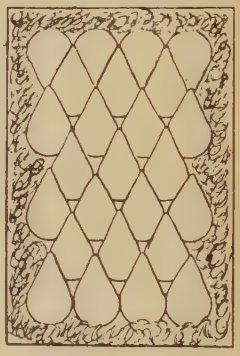
7–2 × 2 = 14.

Selected.



6–3 × 3 = 18.

Choice.



7–4 × 3 = 25.

Note.—In all the packs illustrated in this article, especially the pear pack, an excessive amount of wood-wool is shown between the fruit and the sides of the box. The wood-wool should show as over-lapping the fruit.

Grapes.

To lay down a system for the packing of grapes is very difficult indeed; many different styles of packs have been exported successfully. The 10-lb. box should be used for such varieties as Gros Colman, Gros Maroc and Henab Turki; for most other varieties the box of $5\frac{1}{2}$ in. depth is satisfactory.

The box should first be lined with wood-wool, not an excessive quantity, but just enough to keep the grapes from coming in contact with the sides or bottom of the box. The bunches should be properly trimmed, all straggly berries should be cut out, and only one bunch should be wrapped in a paper (this at present only refers to "extra selected" and "selected" grades. The bunches should be completely wrapped. When placing the bunches in the box, they should be put in a slanting position to prevent the weight coming

on the point or end of the bunch, and enough wood-wool should be placed between the bunches to keep them apart and firm in the box. An excessive amount of wood-wool is most detrimental to the keeping qualities of the grapes; the gross weight of the box should be at least 14¼ lb. to allow for 10 lb. of fruit. Packers should frequently weigh their boxes to be sure of getting the correct net weight.

The following is a guide to grape packers in grading their grapes, as to the size of the bunches, and size, or rather number, of berries, to the pound, also the sugar-content of the grapes. The figures given below are for the "selected" grade. The packing of a large number of small bunches of a few berries in one wrapper should not be practised.

Variety.	Weight of bunch.	Berries to lb.	Sugar percentage.
Hermitage	8 oz.	100	19
Hanepot	10 to 12 oz.	80	20
Rosaki and Waltham Cross . .	10 to 12 oz.	75	18
Barbarossa and Lady Downe .	12 to 14 oz.	95	19
Molenera Gorda, Gros Colman and Henab Turki	14 to 16 oz.	70	19
Raisin Blanc	10 to 12 oz.	80	19

By taking an occasional bunch and testing it by the above system, the packer will be able to arrive at an ideal size for "selected" grapes. Any grapes larger than the above, provided the berries are of uniform size and free from all blemish, can be packed as "extra selected" grade.

It will be noticed that in the illustrations of the packing of nectarines, peaches and pears there seems as if an excessive amount of wood-wool has been used. The packer will note, however, that the diameter of the fruit is printed under the illustrations and that, if the fruit is correctly sized it will be impossible to get more fruits into the boxes than the illustrations state; these are made to show the packer the manner in which the several fruits should be placed in the box.

CHAPTER XXXI

FRUIT DRYING, CANNING AND JAM-MAKING INDUSTRIES

The drying of fruit on a commercial basis has been carried on chiefly in the Western Province of the Cape, and the business there has assumed fairly large proportions. More recently it has been extended to the Eastern Province, where in the neighbourhood of Cookhouse many thousands of apricot trees are grown, the fruit from which is utilised by both canning and drying establishments. In the Orange Free State evaporated apples are produced near Clocolan on a fairly large scale and some attempts are being made in the Transvaal in the same direction.

The chief production is centred in the Western Province of the Cape and embraces the drying of apricots, apples, peaches, plums, pears, prunes, figs, nectarines and grapes in the form of raisins, dried grapes, sultanas and currants.

This industry has naturally marched side by side with that of the fruit-growing business generally and has proved of the greatest assistance as an outlet for much fruit which has not been quite up to the size required for export and canning purposes. A first-rate dried article can be produced from fruit which is not of the very largest size and most perfect colour, and whereas both the export and canning requirements lie in this direction, it will be seen that there must remain a very large quantity of fruit suitable for drying purposes.

Further large quantities of various kinds of fruits are specially grown for drying, such as grapes, figs and prunes. By far the larger portion of fruit dried in South Africa is done by the simplest, oldest and best method, *i.e.*, that of " sun-drying." By its means the fruit is prepared for long-distance shipment, the flavour well maintained as well as the nutritious health-giving qualities, and the product may be placed for consumption on the tables of many in the back veld of the country where fresh fruits are quite unobtainable.

The " dried fruit man " is a benefactor to his fellow men and the industry should be a source of profit to him.

The following figures indicate the growth of the industry:

Year.	Apples.	Apricots.	Figs.	Peaches.	Pears.	Prunes.
1910–11	115,964	635,370	54,064	2,575,049	178,306	641,350
1917–18	267,800	366,700	124,900	2,827,900	370,000	887,200
1918–19	232,700	103,200	171,600	1,708,200	346,800	1,021,400
1919–20	170,400	313,500	137,000	1,090,500	116,100	591,300
1920–21	164,900	160,100	132,200	1,824,200	192,200	741,900
1921–22	422,377	980,467	229,638	2,842,367	238,496	1,945,969
1922–23	216,562	1,143,115	242,816	2,394,336	286,458	1,312,405

These figures represent the quantity of dried fruit produced on farms in the Union during the years 1910–11 and 1917–18 to 1922–23. In 1925 we produced 7,299,682 lb. of dried fruits of various kinds, valued at £118,462. Of these, England took £76,192 worth, New Zealand £20,584 and the U.S.A. £10,169 worth.

It will be noticed that grapes are not included in this list. The quantity produced on farms of raisins and currants between the years 1903–4 to 1922–23 was as follows:

Year.	Stalk.	Loose.	Sultanas.	Total.	Currants.
1903–4	60,520	1,726,895	43,116	1,830,531	7,794
1910–11	125,310	2,230,787	157,572	2,513,669	11,159
1917–18	496,287	4,716,526	1,148,588	6,361,401	113,853
1918–19	269,900	3,823,800	821,800	4,914,900	68,000
1919–20	411,800	3,907,600	852,700	5,172,100	68,000
1920–21	1,106,500	5,452,100	1,835,400	83,504,000	77,500
1921–22	3,028,154	10,114,315	2,498,883	15,641,352	118,515
1922–23	2,215,642	5,891,976	3,713,694	11,821,312	179,364

In 1925 the export alone of raisins reached the figures £56,782 which were realised by 4,092,961 lb. of raisins.

In 1924 the yield for export purposes was greater, being 6,666,015, valued at £93,144. In 1927, 3,613,931 lb. of raisins were exported.

If the figures are compared, one year with another, it will be seen that fluctuations of considerable magnitude occur between some of them; this is due partly to the varying seasons and also to the expectancy of demand, but, on the whole, a steady, if not a rapid, increase is shown.

Although much expansion has taken place in our dried fruit trade it may be as well to say that in comparison with other countries South Africa is a very long way behind. Take the dried apricot output which in 1923 was in South Africa about 600 tons. The same season the Californian dried apricot crop amounted to just twenty-four times as much. In the matter of raisins the following figures

will demonstrate the position South Africa holds in connection with the business.

The stocks of raisins and sultanas on hand at the Port of London at the end of the year 1926 and two previous years were:—

Raisins (tons).	1926.	1925.	1924.
Australian	33	871	855
South African	22	75	48
Valencian	125	799	158
Turkish	23	104	92
Californian	130	416	111
Sultanas (tons).			
Australian	2414	1229	3074
South African	6	55	3
Greek	605	752	1521
Smyrna	2375	707	1817
Californian	925	760	58
Persian, Indian and Afghanistan	97	114	210

It is pretty obvious that we must give a long pull, a strong pull, and a pull altogether to make up the lee-way, for South Africa is really a long way behind.

There is every reason why this should be done—the sun shines no more brightly in any other country than it does in South Africa, there is no climate better suited to the production of dried fruits of the very choicest, no racial animosity exists in the ranks of the fruit growers and especially the dried fruit men, witness the South African Dried Fruit Co-operative Society, which is a model to the rest of the Union. Our growers are at least equal in intelligence to those of any other country and our fruit is equal in quality. So that if that pull is given with a will our output of dried fruit ought to get on better terms with our rivals as to quantity in a few years.

Complaints have been made that South African dealers in the product were slack in their business methods, that they would not quote for orders overseas when such could be had for the asking. How could they do anything of the kind when they had no stocks? Our supplies were entirely inadequate.

Fruit Drying Methods.—All apricots, peaches, pears and nectarines have to be cut in halves for drying. Apples are made into "rings," chunks and Normandy pippins. Plums, prunes and figs are dried whole and raisins and currants are treated rather differently. The necessaries for drying the first class of fruits mentioned consist of:—

1. *A Suitable Drying Ground.*—This must not be situated so that it is exposed to dust storms, or even the dust from a road.

Trees must not be so near that they will cast a shadow over the fruit drying, which must be exposed to the full power of the sun's

PITTING APRICOTS UNDER THE OAK TREES. R. TAYLOR'S FARM, WELLINGTON, CAPE PROVINCE.

[*Photo by Keith Taylor.*

rays (when needed). Water in sufficient quantity to lay the dust and afford a supply for the requirements of the workers.

2. *A Pitting Shed*, under which the workers can stand at their work of cutting the fruit. It can be made cheaply of Spanish reeds

DRYING GROUND AT R. TAYLOR'S FARM, M'FOSHOLA, WELLINGTON, CAPE PROVINCE.

[*Photo by Keith Taylor.*

or even bush, or fruit trays at a push. As a rule this is a temporary affair, only used for a season and destroyed. If necessary, however, a fruit house can be erected near the drying ground and used for the purpose, not only of housing the pitters when at work, but also of storing the picking boxes and general impedimenta of the orchard and acting as a store-room for the fruit after drying. When it is taken to an exchange warehouse soon after drying, such a builidng is scarcely needed for that purpose, and it can be built in a less expensive manner than a store-room for dried fruit would require. The shed should contain tables for the trays to be placed on and knives for pitting, with special ones for cling stone fruits. Machines for pitting are to be had, but a satisfactory one is difficult to find.

3. *Drying Trays* are needed on which to spread the fruit out after pitting. *Not* the old-fashioned improvised ones made of reeds, but good, solid trays of one uniform size throughout. The size generally in use measures 6 × 3 feet and is made of either imported wood or procured locally. Such a tray requires—sides and ends of 2 × 1-inch wood with 12 pieces 3 feet × $\frac{1}{4}$-inch to form the bottom and 3 pieces 6 feet × $\frac{1}{2}$-inch for nailing on under each side and one in the middle of the tray. It takes two men to handle trays such as these when full of fruit. Trays 8 feet × 3 feet are also used.

4. *A Shed for Shelter*, under which the trays may be stacked one on the other when required. This should be a good-sized affair as it may happen that all the trays with fruit on them may need stacking on account of heavy dews or possibly rain, and in some instances when the sun is so extremely hot the fruit will not need more than a few hours' exposure to its rays; then the trays are taken in and stacked under the shed. They will remain so until drying is complete; the cleats underneath each tray ensure that air passes through and over the fruit. No definite time can be given for the proper drying of the fruit. It all depends on the atmospheric conditions and may take anything from four to fourteen days, the latter when the trays are stacked.

5. *Sulphuring Houses* or boxes must be provided sufficiently large to take a pile of trays 4 to 5 feet high, more or less. When only a small quantity of fruit is handled, it is sometimes customary to make a box sufficiently large to cover a given number of trays; it may be made of canvas on a frame of 2 × 2-inch pine. Five acres of apricots, peaches or pears would justify the building of a proper sulphur house. The size of this may be 8 × 4 × 6 feet high inside measure. If built of wood, tongued and grooved material should be used in order to keep it air-tight. Many are built of brick and it may be necessary to have more than one house when the orchard is large enough to require it. Such "houses" are distinct from the "boxes" and should have a 2-foot light rail track leading from the pitting shed right into the

sulphur house. A truck about 12 inches high with a frame for placing the trays on is needed. The trays when full of fruit are piled on the truck which is pushed into the sulphur house. The door must fit tightly and this is secured by lining the jambs with felting. A hole is made in the ground in about the middle of the box in which the sulphur is placed in a tin basin or other suitable utensil. It may be ignited by dropping a lighted paper or coal in it before the truck is wheeled in. The quantity of sulphur used and the time during which the fruit is exposed to its fumes will depend on circumstances and conditions which the individual drier can better determine than anyone else. As a guide, it may be stated that for a house the size mentioned from 1 to 1½ lb. of

APRICOTS BEING PLACED IN SULPHUR HOUSE.
[*Photo by Keith Taylor.*

sulphur burned for 1½ to 2 hours should be approximately right. The author has on occasion allowed the fruit to remain in the house all night—that means the last lot of trays put in, when one is thoroughly tired out and unable to stay up any longer.

There are occasional waves of public opinion which demand the abolition of the use of sulphur. It is freely stated by the faddists that sulphured fruit is not wholesome. Amongst the earliest experiences of many of us it is possible to remember being dosed with sulphur (called "brimstone") and treacle, and sulphur tablets are still prescribed by physicians. As a fact, the quantity of sulphur consumed in the eating of a pound of dried fruit is entirely negligible and how many of us eat a pound at a time?

The sulphuring of fruit is not done with the object of bleaching

it, as is commonly believed; it does not bleach the fruit, but preserves the natural colour so that it does not become dark and objectionable looking, as all fruits do which are not so treated.

It also secures it from the attacks of insects when exposed to the sun on the drying ground and afterwards. The practice of "sulphuring" makes the dried fruit business possible. If our fruit was not sulphured it would be quite impossible to offer it for sale.

It would be a very objectionable-looking mass of dark brown or black material, riddled with the work of insects and their excreta and having the most objectionable smell.

6. *Sweating.*—After the fruit is taken up from the trays, it is found that each piece is not equally dried; some of the smaller ones will be quite hard and dry while some of the larger sizes will remain a little on the damp side. In order to equalise matters, it is usual to throw the lot into large heaps, when in absorbing the moisture from the larger pieces the small ones become a little more moist and *vice versa.* When the fruit is in heaps like this it is necessary to shovel it over occasionally or it has a tendency to become still more moist.

If it is more convenient to sweat the fruit in picking boxes, as may sometimes be the case, it is well to turn the contents of one box into another until all has been changed over, and repeat this occasionally. This method is not as satisfactory as the other.

Packing in boxes for the market is the final operation, and this is a matter which is very largely in the hands of the large fruit drying and packing establishments. The fruits mentioned so far, if in good condition and well prepared, require no "processing."

When the fruit is placed in the boxes, which are of one standard size, fair samples are selected and flattened with the finger and thumb so that they may show to the best advantage; sometimes apricots and peaches are passed through a pair of rollers such as may be seen on a wringing machine, but care must be taken not to burst the specimens. When they are ready, they are placed carefully, cut side downwards in the case of peaches and pears and uppermost in the case of apricots; each half must be set neatly in its place, usually two rows are put in this way and the balance of the fruit, sufficient to make up the correct weight of the box, is put in and pressed down firmly so that the lid may be nailed on, the box is then turned upside down and the bottom becomes the top.

Apples are dried both in the sun and by means of an evaporator, or "dehydrator" as the article is now called. Most of our South African dried apples take the form of "rings" and to produce these properly a machine is used which cores and cuts them neatly and rapidly. Two or three different makes are to be had. The colour of dried apples is the most important point in their preparation.

It is necessary that they have as light an appearance as possible, a brownish-looking article is not cared for. Sulphuring becomes, therefore, an important factor. When coring and cutting ready for drying, the fruit is sometimes put into brine made of ½ lb. of salt to 1 gallon of water as it leaves the machine, and allowed to remain there for half an hour or more; this makes for a nice bright, light-coloured article.

Normandy pippins may also be produced, but the demand for this type of dried apple is not great in South Africa. The method is very simple and consists of the paring and coring of the fruit without the slicing done in making "rings." Machines are available for doing this and in some cases the one used for rings may be adapted for the purpose. As the pippins are larger and thicker than "rings" the brine used should be made stronger, about ¾ lb. to a gallon of water being used, though some prefer a little more salt. The time for drying is, of course, proportionately longer.

"Chunks" are not much in demand, but are usually produced from partly spoilt fruit. The sound parts are used and as a rule hand cutting of the apples is done. Occasionally they are halved and quartered, but the output is only small.

Sun-dried apples are as a rule of really good quality, but in the areas of summer rainfall it is impossible to carry on extensive operations by this means. It is in these districts one finds the large evaporators erected. Mr. Perkins, who dries apples extensively at Clocolan in the Eastern Free States states that his favourites for drying are Ohenimuri, Rome Beauty and Commerce, and that the evaporator in use on the property can turn out one ton of dried apples a day—a day of twenty-four hours being worked. It takes 10 lb. of green fruit to secure 1 lb. of dried.

Apricots are ready for drying when, and not before, they are ripe. An unripe apricot makes a badly-coloured dried article. They must be picked from the trees and handled with care; bruised apricots do not make good dried fruit, every bruise shows a black spot after the fruit is dried. Over-ripe fruit is almost as bad as unripe. It is liable to break down during the drying process and become a juicy mess. When dried, this class of fruit has little chance of selling in competition with properly prepared goods; such a product is termed a "slab." In cutting apricots for the drying tray, the two halves must be completely severed, and not allowed to hang together by a piece of skin. They are placed on the trays cup side upwards and remain until ready to take up. Very often the trays are stacked after the fruit has been exposed to the sun for a few hours; as previously stated, the best fruit is produced in this way. The exact period for taking the fruit up is for each individual

owner to decide. The correct time is when each half has gained a leathery feel and there is not the slightest sign of juice about it. If a handful of fruit is taken up and squeezed and the fruit sticks together and does not fall loosely back again, it is not ready for taking up.

It takes about 6 lb. of green fruit to make one pound of dried apricots, depending on the variety. Whole apricots are not in demand, they have not as attractive an appearance as those which have been cut open. The flavour is, however, considered to be better if the fruit has been properly handled. The aroma is contained within the skin, just as potatoes which are cooked with their jackets on are supposed to have a better flavour than when they are peeled. Apricots dried whole require to be sulphured for at least three hours; they should first be graded for size, otherwise drying is apt to be irregular and the fruit does not become all of one texture as quickly as the cut halves do.

Peaches.—The yellow varieties of peaches only are considered from a commercial aspect for drying purposes. The treatment adopted is very similar to that used with the apricot, excepting that peaches may be dried either with or without the peel. Peeled peaches are, however, not in demand to anything like the extent that the unpeeled are. When it is necessary to produce peeled peaches a very simple method of peeling the fruit, termed "sulphur skinning," is adopted; it consists of pulling the skins off the fruit when it comes out of the sulphur house, the sulphuring causes them to slip off quite easily, they may be placed on fresh trays for drying and care is needed not to upset the juice in the cup of the fruit. The process is tedious, the loss of weight a consideration and the increased price not always worth the extra trouble.

Peaches require longer sulphuring than apricots, from three to four hours being about the right time. They must be made rather drier than are apricots; the fruit, in fact, when taken from the trays, just showing interior moisture and no more. Careful picking is a *sine qua non*, as bruised peaches make inferior dried fruit. Shrinkage during drying operations depends on the variety used. Muir shrinks less than any other peach, giving 1 lb. of dried to 4 or 5 lb. of green fruit, depending on the locality.

Most other yellow peaches for drying, such as Crawford, Foster and Elberta, will dry out $6\frac{1}{2}$ to 7 lb. to one, and the more solid-fleshed cling stones, such as Sellars Cling and Lemon and Orange Cling, will go a little less. Spoon-shaped knives are used to pit cling stone peaches; they are stocked by many hardware merchants.

Pears.—The best dried pears are those made from the Bon Chrétien variety, although many other kinds are used. Fruit unfit for export owing to over-ripeness is just the thing for drying purposes. The

drier wants his pears yellow and ripe so that he can readily pull out the stem and cut out the core; for the latter purpose the spoon-shaped knife is best to use. Very few pears are dried minus the skins; shrinkage is a heavy item when this is done. In the ordinary way, the fruit is halved by cutting it from the stem end to the calyx, the halves are placed on trays cut surface upwards and sulphured for at least *ten* hours. This heavy sulphuring produces the desired colour in the fruit. After sulphuring, the trays may be placed in the sun for a day and then stacked in the shed for the remainder of the curing to take place. A clear, translucent-looking article is aimed at with little moisture and of the same leathery consistency as the dried apricot should have. A good pack of dried pears can be made without using the largest specimens, but particular attention must be paid to the exclusion of all fruit affected with codling moth or any other insect-injured specimens. It takes 4 to 5 lb. of green fruit to make 1 lb. of dried.

Plums.—This means any kind of plum used for drying except the French prune of commerce. Japanese varieties, such as Satsuma and Kelsey, have been more in evidence than others. They may either be dried whole or in halves, the latter being the favourite method. Hand work for cutting the fruit in this connection has been hitherto relied upon. The methods employed are the same as for the apricot.

Prunes.—This item includes all the varieties of prunes which are grown in South Africa for drying purposes. Almost all, however, are of the D'Agen variety, which is undoubtedly the best for the purpose.

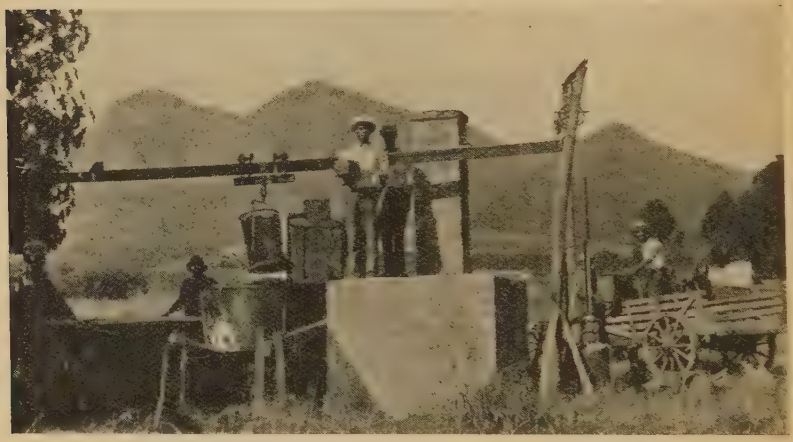
In order to make the best dried article the fruit must be allowed to drop from the tree, in that way only can dead ripe fruit be secured. A slight jar to the trunk of the tree will often cause a lot to fall and this may be done, but no actual shaking of the branches should be permitted until the very last picking, when it is necessary to make a clean sweep of all that is left.

In drying, all prunes are either pricked or dipped in hot water containing lye, it should be as near boiling point as possible, and a pound of lye should be allowed to every 25 to 30 gallons of water. Some both dip and prick the fruit; the object is to ensure that the skins get cracked, so that in the actual process of drying the moisture may escape from the fruit readily.

Machines are to be had and are in use in all the large drying establishments which combine both the pricking and dipping process and also deposit the fruit on the trays when that is completed.

Home-made appliances are found satisfactory for dipping. A strong upright post about 8 feet high with an iron spike set in the end about $\frac{1}{2}$ inch in diameter with 6 inches inserted in the post and

6 inches exposed is fixed in the ground. A piece of scantling or other suitable wood about 10 feet long with a hole in the centre is placed on the upright post and held there by placing the iron spike through the hole. Then a dipping basket of suitable size is suspended from one end of the scantling and a short rope at the other by means of which the operator can raise or lower the basket at will. He lowers the basket full of fruit into the dip, and after it has remained there for about ten seconds, until the skins have cracked, he raises it and lowers it to the tray to be spread out for drying; some growers pass the fruit through a further dip of pure cold water after the lye bath, but this is not actually necessary.



HOME-MADE DIPPING APPLIANCE USED BY THE DONKERHOEK FRUIT SYNDICATE, SIMONDIUM.

The trays are spread in the sun for about a day, and then stacked in the shed—the time needed for the drying depends on weather conditions; if damp, then it is much longer than when nice drying winds are prevalent. The condition of the prunes before taking them up from the trays should be just so that they will not hang together when a handful is taken and squeezed. They must be dry, but not too dry, there may be some which have fermented and swollen up due to the skins not having cracked; these are called "bloaters."

After the prunes are taken up from the trays, they are either sweated in lug boxes or else in bins or heaps on the floor of the fruit room for about twenty-one days; this sweating not only evens up the moisture contents of the mass, but when the fruit is turned over, as it should be two or three times during the sweating process,

the texture of the skin improves also. At this period it is sent to the pack-house or boxed up on the farm; the latter is rarely done in South Africa.

Before boxing, the fruit is "processed," being passed through a boiling hot dip in order to glaze the skins, destroy any insect pests, and finally clean the fruit. The gloss is produced by various means, some add sugar to the water, others glycerine; most pack-houses have their own special formula.

The final operation before boxing up is the grading of the fruit into the standard sizes; these are 30 to 40, 40 to 50, and so on, up to 120, meaning that so many prunes of these particular sizes go to make up a pound in weight. The fruit is packed in the South African standard box. Prunes dry out at the rate of $2\frac{1}{2}$ to 3 lb. of green fruit to 1 lb. of dry. In 1927, 504,000 lb. were exported.

Figs.—The dried fig of commerce *par excellence* is the Smyrna fig. It is produced to perfection in Smyrna, which is the general packing and export centre for this industry in Europe. California also dries the same fig; they call it the Calimyrna, but their product is not equal to the Smyrna article.

Here in South Africa we also dry figs, but they are mostly of the White Adriatic variety. The dried fig which our growers should set before them as an example to work up to is the Smyrna article, as supplied from that centre. It is the best in the world to-day. In order to produce this, it is imperative to have the right kind of fig—the Smyrna.

Mr. George Roeding, of Fresno, California, who has done more than anyone towards the stabilising of the fig industry in California, and who is himself a large drier of these figs, states in his book, "The Smyrna Fig at Home and Abroad":—

> "The figs are gathered from the ground, the branches are shaken, and the figs placed in buckets and carted to the drying ground. Brine is made by adding three oz. of salt to each gallon of water and it is brought to the boiling point. The figs are placed in perforated buckets and submerged in the solution for about a minute, the buckets being raised and lowered several times during this interval to allow the water to drain off. The dipping in salt water is to hasten the drying and soften the skins. The beneficial effect of this treatment is specially noticeable in figs which have become a bit over-dried on the tree before falling off.
>
> "As soon as the figs are dipped they are spread on trays in one single layer, no care being taken as to whether they touch each other or not. In the early part of the season, the figs are not allowed to remain on the trays in the sun

for much over two days. The second day, the figs are turned, quite a simple matter, an empty tray is placed over a full one. Two men at each end by a dextrous movement of the hands transfer the figs from the filled tray to the empty one.

"If the figs pile up when turned, they can easily be spread out again by merely shuffling them around with the hands.

"The trays, after two days' exposure, are piled up so that the air will pass through them freely. This stacking is not absolutely necessary, but it benefits the figs, first by preventing them from drying out too rapidly, causing the skins to become tough and hard, and, secondly, the figs dry more evenly.

"One great mistake in handling figs is that in many cases they are over-dried, which, more than anything else, is the cause of tough skins. The proper degree of dryness is determined by examining the figs early in the morning before they become warm. If, when worked between the fingers, they have a slightly leathery feeling, they are dried sufficiently.

"The work of sorting now commences. Many of the large plump and meaty figs will, on examination, be found not to be dried enough; these are sorted out, placed on trays and exposed to the sun once more until they become dry enough. The other figs are thrown into a pile in the fruit room and turned over every few days. Meanwhile, the sweating process continues, the skins of the figs become moist and pliable, and, although the figs are apparently wet, it is really nothing more than the sweating and curing process they are passing through. After remaining in the pile for about ten days the figs are in a condition to be packed.

"During the process of drying and handling, more or less dirt adheres to the figs, so that they are given another washing before being packed. The figs are placed in cold brine made by dissolving 4 oz. of salt in each gallon of water. All figs which float to the top are removed first. These are over-dried and are called 'bloaters.' Those which sink to the bottom are given a thorough washing between the hands and are then taken out and placed on trays. They are piled on these trays a couple of inches deep and are then exposed to the sun for half a day, being turned once during that time. This final exposure is made to remove all superfluous moisture from the figs. The figs are dumped into sweat boxes and are now ready for packing.

"If they have been handled carefully they will have a tender skin and be soft and pliable and present a fine, glossy white appearance. The skin of the Smyrna fig, when dried, is white and to one not familiar with its natural tendency to have this

colour the inference would be that the figs had been sulphured. This is always objectionable, but is found necessary with the White Adriatic in order to give the skin a white colour, but this gives the fig a bitter flavour and extracts what little of the true fig flavour this variety originally possessed."

White Adriatic figs, such as are dried in the South-western and Western Provinces of the Cape are not processed to quite the same extent as the Smyrna. It is customary to gather the ripe fruit and place it on trays just as is done in the case of the Smyrnas. They are placed in the sulphur house and kept there for at least 6 hours; after being thoroughly sulphured, the trays are spread out in the sun for a day or two (usually one is sufficient) and then brought in and stacked in the shed. When sufficiently dried, they may be taken up and placed in heaps to undergo the sweating process. The test for correct stage of dryness is when the fruit has somewhat the feeling of soft leather. They should be dry but not too dry. The appearance of the White Adriatic fig when dried is quite attractive, the flavour sweet and tasty, and, though not equal to the Smyrna, it makes a very excellent dried fruit. There is, further, a good market for it at prices which allow of the producer realising a fair profit. The bulk of the dried figs produced finds its way to the market *via* the co-operative pack-houses, where the finishing touches are put on prior to boxing and dispatch.

Raisins, Sultanas and Currants

The bulk of our products in the above are the output of the South-western and Western Provinces of the Cape. The industry may be said to be well established but most insufficiently developed. South Africa could easily produce twenty times the quantity of dried grapes that she does at present and the markets of the world would still want more.

Reference has already been made, and figures have been given indicating the status of the Union of South Africa as a raisin-producing country. The figures shown seem fairly large and represent a large quantity of grapes of one sort and another, but it cannot be too clearly and emphatically stated that as a raisin-producing country South Africa has not entered into her heritage. No good purpose would be served by seeking to point out the reason for this, but it is clear that when such discrepancies exist as may be seen between the exports of Australia and those of the Union, there must be something amiss somewhere.

Raisins are produced principally at present in the districts of Worcester, Montagu, Robertson and Wellington. There are, however, other parts of the country where equally good samples can

be shown; for instance, Oudtshoorn, the Orange River Valley round Upington and the banks of the Oliphants River, west of van Rhynsdorp, the Graaf Reinet and other adjoining areas. Karroo soils, with a large admixture of lime frequently present, afford excellent opportunities for the production of the very best Hanepot, Sultana and Corinth grapes. The climate is also very hot in summer and cold in winter, indeed sometimes a little too cold, although serious damage rarely results from a cold snap.

Raisins are made in South Africa almost entirely from the Hanepot grape, which is identical with that most celebrated variety the White Muscat of Alexandria, from which a very large proportion of the world's raisin supply is produced. In a lesser degree, resort is had to a few other kinds such as Gordo Blanco and occasionally Waltham Cross and Canon Hall Muscat.

The production of raisins resolves itself into two distinct classes of dried fruit. Raisins which are used for dessert and those used for culinary purposes; these are called respectively Muscatels, Malagas, or Stalk Raisins and Table Raisins and are untouched by any kind of dipping material, as against Pudding Raisins, Loose Raisins and Lexias, all of which undergo a dipping process in their preparation for market.

Unlike California, which State produces most of the raisins consumed in the United States, the bulk of which are never dipped, the majority of our raisins are dipped and so belong to the Lexia class. The method of preparation is simple, but a few prominent features must be observed if a good marketable article is to be secured.

1. The grapes at picking time should be fully ripe and contain at least 25% of sugar.

2. All diseased or sunburnt berries should be pulled from the bunches at picking time, before they are put into the baskets.

3. The strictest cleanliness should be observed throughout every operation connected with the drying process.

4. The drying ground should be situated well away from any danger of dust from roads or from any other source. The ground should be level and clean.

5. Trays for spreading the grapes on should be cleaned regularly whilst in use. Trays made of reeds should not be used. Trays may be 3×3, or 6 or 8×3 feet, according to the ideas of the grower; the former are far easier to handle.

6. The grapes must *never* come in contact with the ground. The fact that, in the past, many of our growers dried their grapes on the ground resulted in the production of a very poor sample of raisin. Muscatel or Malaga raisins are the simplest and easiest to handle. The grapes are picked and taken to the drying ground,

where they are sorted out into three different grades which are determined principally by the size of the fruit as regards both bunches and berries; this work is necessary, not only to make the sorting out simple and easy after the grapes have become raisins, but also that the bunches being about the same size may dry uniformly.

As the different grades are in course of formation, or as soon as sufficient grapes are available of any one grade, they are taken from the sorter and spread on a tray. The trays are laid on the ground side by side with a pathway between the rows. The grapes are allowed to remain exposed to the sun until sufficiently dry to take up; the exact period will depend on the weather experienced during the drying process, and may vary from ten to twenty days. Stacking the trays one on top of the other as described for dried prunes produces a good article, but if trays are scarce the practice is not economical, as the time required keeps such a number of trays out of commission. Should the evenings and nights be likely to be wet or if heavy dews fall, the stacking of the trays is imperative and a few should be placed over those at the top of the stack to prevent damage from this source. During drying, that side of the bunches exposed to the sun naturally dries first, so it is necessary then to turn the fruit over so that the other side of the bunches should be exposed; this is done very quickly when 3 × 3-feet trays are used. An empty one is taken and placed exactly over the last one in the row, then both are taken and turned completely over; the result is that the new tray takes the grapes with the unexposed side uppermost and the process is repeated all down the row. By this means equality of dryness is secured. The same process is observed with the larger trays, but it is not as rapid or as satisfactory. In California, small trays only are used and the drying is often done in the roadways of the vineyard.

When the raisins are taken up from the trays, they are usually packed in single layers in sweat boxes with a sheet of thick paper between each layer, this needs to be done with care, and after an interval of twenty-one days the bunches may be packed in boxes in accordance with their size and quality and in conformance with the demand of the particular trade for which they may be destined.

Careful handling of the muscatel raisin from the time of picking until it is in its final package is imperative if the best article is to be produced. The least possible handling of the bunches is desirable, as every touch of the fingers on the grapes will injuriously affect the "bloom." As with all other dried fruits, the appearance of the raisins when the boxes are first opened is of very great importance; a good impression is at once created.

Pudding Raisins.—All grapes of this class are dipped in a solution

of lye which may be made, as it often is in the raisin-making districts, by using a couple of pounds of " Ganna As " (the burnt ash of the " Ganna Bos ") to each gallon of water used in the dip. Commercial caustic soda is also used, the strength of this being much greater; it is found that 1 lb. is sufficient to use in every 20 gallons of water. This dipping process is the one material difference which exists in the treatment of the grapes for their respective purposes.

The same degree of ripeness is necessary as is the case with the muscatels; the grapes are picked in ordinary baskets and taken to the drying ground, there they are emptied into a wire basket for the purpose of dipping, the basket used for prunes is equally suitable for raisins—in fact, the same outfit may be used. The " dip " must be kept constantly on the boil. A vessel full of boiling water alongside the dip is sometimes provided, into which the basket of grapes is lowered for a moment and withdrawn, before being again lowered into the " dip," where it may stay for a couple of seconds. It is unusual to find the " Ganna As " dip too strong, but such may not be the case with a dip made with caustic. The object of dipping is slightly to crack the skins of the raisins so that they may dry quickly and well, and at the same time clean the fruit. Should the skins peel back from the pulp of the grapes and the cracks be only few in number, it is a sign that the lye is too strong or that the grapes have been immersed a little too long and the necessary steps must be taken to correct matters.

The grapes are then turned carefully out on the trays in a single layer and placed in the sun. They may remain thus for about three days, when the exposed fruit should have assumed a nice brown colour; it is then time to turn them and expose the other side to the sun. Weather conditions affect the time needed for drying; if the atmosphere is damp and muggy it may take from eight to nine days, but if dry and clear then about six days should be ample. As with cluster raisins, the trays should be stacked at night and protected by means of empty trays placed on the top and at the sides if necessary. The trays are spread out in the morning as soon as the sun is up.

When thoroughly dry, the raisins should be passed through a stemmer and grader (there is a machine for the purpose), which separates the raisins from the stalks and delivers them sorted into four sizes to boxes placed for their reception.

The next process is that of sweating and this may be done in ordinary lug boxes or on the *clean* board floor of a fruit room. In either case the raisins must be turned over two or three times during the curing period. When all are of the same uniform state of dryness, they may be sent to the co-operative fruit warehouse for final handling and packing, or this may be done at home.

Sultanas are treated similarly to muscatels or Malagas, but there are a few points in which the treatment differs. The oversea markets demand, and are willing to pay more for, a bright, light-coloured sultana than for others, perhaps equally good or even better, which are of a darker hue. This makes sulphuring necessary. The usual procedure is the dipping in lye, then a second dip in clean cold water and placing them on the trays. These are run into the sulphur box and allowed to remain for two hours submitted to the fumes of the burning sulphur; for a box or house 4 × 9 × 8 feet about 3 lb. of sulphur should be used. From the sulphur house to the drying ground is the next move and the fruit must be turned the second day after exposure and again twice more at intervals of a day or two. The usual sweating process is gone through and the fruit stemmed and graded. The best samples of sultanas have not a single stem left in a boxful.

Currants are produced from the Zante grape, which is grown on an altogether too small scale in South Africa. The procedure is very simple. The grapes are allowed to remain on the vines until in the condition known as " dead ripe," they are then gathered, placed on trays, and set out in the sun to dry; this takes about four or five days and the fruit is turned about the third day. Drying by stacking after half a day's exposure is sometimes practised and the exponents of this method say that they secure a better article by its use.

In any case, the currants should be fairly on the dry side when taken from the sweat boxes, so that when finally packed for marketing they should not resolve themselves into a solid, sticky mass, as is often seen. They should open out so that each individual berry should be separate and self-contained, as much like little peas as possible. Stemming is necessary and the best are put through a brusher prior to packing. In 1927, 3,613,931 lb. of raisins and 10,042 lb. of currants were exported.

Canning and Jam-making.—During the last few years remarkable developments have taken place in these industries. Where there were less than half a dozen so-called factories in 1902, there were in 1925 some 24 establishments devoted to the canning and bottling of fruit and vegetables of one kind or another. The bulk of this industry is centred principally in the coastal towns and districts, chiefly on account of the fact that by so doing the charges on wood, tin, glass and other goods used in connection with the business, which have to be imported, are far less than would be the case if they had to be taken inland to any distance, the saving in the matter of transport being very considerable. As a rule, other facilities are present, such as a plentiful supply of labour, light and power, which might possibly be more difficult to obtain inland unless near one of the large towns.

The chief centres of the fruit canning industry are Port Elizabeth, Capetown and Durban, in the order named, with rural areas such as Paarl and Worcester in the Western Province of the Cape. The fruit dealt with consists principally of pears, apricots, peaches, plums, grapes, apples, pineapples and figs; canned grape-fruit has recently been added to the list.

Practically all the establishments which are interested in this business are private ones, co-operation has not advanced sufficiently far enough to warrant the erection of a cannery on a co-operative basis. The labour equipment of these canneries embraces white, coloured and black, the former being utilised for the more advanced phases of the work.

Imports and Exports.—Without giving the official returns dealing with all classes of bottled and canned fruits for every year since Union, it may be well to call attention to the fact that in 1910 South Africa imported canned fruits to the value of £17,314 and in 1925 the figures were almost identically the same, indicating that we are unable or unwilling to do without a certain type of imported article in the preserved fruit line.

It is, however, when the export figures are examined that the extent of the growth of the canning and preserving industry becomes illuminating. In 1910, the year of Union, South Africa exported bottled and canned fruits to the value of £1,263, principally to the Congo and what was then called German South-west Africa. In 1925 the export of canned pineapples alone amounted to £58,150 and this was £10,000 less than the previous year. The total quantity of goods of this class exported during that year was 3,255,658 lb., valued at £72,895, besides jams and jellies to the tune of 241,218 lb., of a value of £7,000. It is only right to say that the development of the canned pineapple industry is almost entirely due to the African Canning and Packing Co. at Port Elizabeth.

It has been stated and is pretty generally known that a large quantity of our finest fruit is exported; there still remains, however, an enormous quantity of choice fruit which entirely fills the requirements of the factory. Canners require all the fruits they utilise to be " fully coloured but not ripe " and have in addition preferences for certain varieties which suit their purposes better than others.

Taking the list of fruits for the cannery we find the demand is for:—

Peaches.—Practically all the yellow clings, with preference for Tuscans, Lemons, and Sellars, with a few free stone varieties such as Elberta, the Crawfords, Mary's Choice.

Apricots.—Royal, Old Cape, Blenheim and Tilton with Moorpark when it is to be had.

Pears.—Bon Chrétien principally, with Keiffer and a few others.

Plums.—Satsuma.
Grapes.—White and Red Hanepot.
Apples.—Ohenimuri, Rome Beauty.
Pineapples.—Smooth Cayenne, Queen.
Figs.—White Adriatic, White Genoa.
Figs (green).—Adam, Old Cape.
Grape Fruit.—Marsh's Seedless.

Jam and jelly manufacture is as a rule carried on in the same establishment as "canning" and the same labour is utilised. The range of fruit dealt with consists of:—

Oranges and grape fruit for marmalade.

Yellow peaches, plums, apricots, grapes, apples, figs, Cape gooseberries, strawberries, blackberries, quinces and guavas.

In addition, "Mebos," an old favourite Dutch confection, is prepared in the factories of the Western Province as well as crystallised fruits of all kinds. The crystallised pineapples of the Eastern Province have an excellent reputation.

Local consumption of South African made jams and jellies is considerable and the product as a rule of good quality. Prices are frequently almost as high for this as for the imported article. It appears to the author that if the product were sold at lower figures better business would result and more be done.

Fruit for jam-making should be picked and handled just as carefully as if it were for the cannery; it is a mistake to think that anything is good enough for jam, strict cleanliness should be observed throughout the handling of the fruit from the tree to the preserving pan. Farm canning of most kinds of fruits and vegetables, although most useful for home consumption, is unable to compete with regular factory methods. The uniformity of both pack and product appears difficult to obtain, and whilst every effort should be made to encourage this branch of the industry, there does not seem to be any commercial opening for this stamp of goods for export.

CHAPTER XXXII

SOME INSECT PESTS

The statement is frequently made that South Africa is a land of pests. The locust, the caterpillar, the orange dog and moths innumerable have made it their home for centuries and have displayed excellent taste in so doing.

As a fact, South Africa is no worse off than most other fruit-growing countries; indeed, compared with Australia, where, in addition to all the pests we have, there is another in the shape of a flying fox, South Africans have really not much cause of complaint. The principal difference between the South African grower and his *confrère* in, let us say, California, is the fact that while growers in that State have been brought up with the knowledge that spraying or fumigation of fruit trees is necessary if a crop is to be gathered, the South African grower is only just beginning to realise that such work is an absolute necessity if he wants to get any returns for his fruit. The present generation here is the first to see to any extent what commercial fruit growing is like, and oftentimes the work of fighting insect pests is regarded as a hardship, while in other countries it is accepted as part and parcel of the necessary routine of orchard work, just as much as cultivating the land or pruning the trees.

Most of the fruits we grow are subject to the attacks of some kind of insect. The Entomological Division of the Agricultural Department of the Union issues a large coloured sheet with illustrations showing many of them and giving instructions as to how to combat the most common of our enemies. Many of the remedies are mentioned here; their use is general the world over, and a number of them have been introduced from other countries. There is no monopoly of them. Many of the more common pests are well known by sight to most growers, but in the case of a stranger it is advisable to send specimens to the Chief Entomologist at Pretoria at once.

Injurious insects are divided into different classes:—

1. Those which destroy the leaves.
2. Those which live on the bark, leaves and fruit.
3. Those which bore into and lay eggs in the fruit.
4. Those which bore into the roots and branches.

Taking the Citrus family first, we find that all orange, lemon, grape-fruit and naartje trees are subject at certain stages of their

existence to the attacks of various kinds of scale insects; some of these are termed "Armoured" and others "Unarmoured." The armoured scales embrace the common and deadly red scale, mussel, purple, long and soft scales. All these are best dealt with by fumigation with hydrocyanic acid gas. There are a number of professional fumigators who do this business. Spraying with various washes, if thoroughly done, may keep scale insects under control during the first few years of the life of the trees, but as a rule, eventually, resort is had to the fumigation process.

One of the first enemies to attack the young citrus tree is the Orange Butterfly, commonly called the Orange Dog. It appears in the spring of the year and lays a beautiful tiny pearl-like egg, mostly on the leaves, when in the very early and tender stages. The egg hatches in a few days and produces a small caterpillar, which at once begins to feed on the young foliage. It grows apace and eventually becomes the size of one's little finger.

It has a healthy appetite, and will, when full grown, eat up a leaf in a few minutes. When a few of these attack a little tree, there is not much hope for the foliage. The destruction of the butterflies' eggs and grubs by piccanins is one way of fighting the pest. Spraying the orchard with arsenate of lead, at the rate of $1\frac{1}{4}$ lb. of the powder or $2\frac{1}{2}$ lb. of the paste to 40 gallons of water, is a safe method, but the work must be repeated should heavy rains come and wash the poison off.

Orange Aphides.—These are tiny, blackish objects which attack the young growths of the orange tree at all ages. They look like little black flies and are often present in myriads. Their presence does not cause really serious damage to the trees, but it is unsightly and objectionable and harms the trees by checking its growth. They are easily got rid of by spraying with paraffin emulsion or a nicotine spray, at the rate of one part of nicotine extract to 100 parts of water. There are good nicotine extracts to be had of local manufacture.

Citrus psylla.—This is a pest which invades citrus orchards spasmodically. Many groves have never been affected. In other instances thousands of trees are affected, apparently simultaneously. It is a native pest and has its home amongst the numerous types of wild fig trees growing in the Bush. The insect is tiny and commences operations by attaching itself to the under side of the leaves. As it advances in life its presence is marked by a small roundish or oval depression on the under side of the leaves, with a corresponding elevation on the upper side. The leaves have a crumpled-up appearance and are altogether unsightly. Serious results rarely follow a visitation of *C. psylla*, but when a bad attack occurs it is quite likely that the next year's crops will be materially lessened.

Spraying with paraffin emulsion or tobacco extract is usually sufficient to put an end to an attack, if it is considered of a sufficiently serious nature to warrant the expense.

Scale insects are likely to be the next enemies from the attacks of which a young citrus orchard will suffer. Of these there is none more dangerous than:—

Red Scale.—It attacks citrus trees of all ages, and unless promptly taken in hand, the loss of the tree is certain. It is one of the armoured scales, as it is completely protected by a shield-like covering. The insects derive their nourishment, live, in fact, on the sap of the trees, and some entomologists state that they have also a poisonous effect on its plant-tissues. During the early stages of the life of a young citrus tree it is possible to control the ravages of the insects by spraying. Numerous proprietary remedies are to be had, and those locally produced are as good as any. Resin wash, home made, is a most useful preparation. As the trees attain age, fumigation is the more reliable method of treatment, as no matter how carefully spraying may be done there is always the probability of some few scales being missed. There are now various methods of fumigating citrus trees. The destructive agent in each case is hydrocyanic acid gas and it may be produced by various different methods.

Mussel Scale is another objectionable pest, which is present in some orchards in the Union. Unlike the red scale, this insect is protected by an elongated shield of a dark brown colour; many of the scales are larger at one end than they are at the other. The presence of this pest on the fruit makes it particularly objectionable; it is amenable to the same treatment as red scale.

Long Scale is similar in appearance to the last mentioned, the scales are longer and thinner and also rather lighter in colour. The control treatment is the same; fortunately this is not a widespread pest in South Africa.

Circular Purple Scale is a round, blackish-looking scale with a small-sized red dot in the centre. It is not common in the Union but is to be found inland as well as in the coastal districts, which, latter it is supposed to prefer. It infests both fruit and foliage, and is a very objectionable and persistent visitor. Fumigation is practically the only satisfactory treatment for this scale.

Soft Scale.—This is probably the most widely spread scale in the country and with the "red" variety may be regarded as a permanent pest. Fortunately, its effects on the orange tree are not anything like as serious as those of the red scale. Its presence on a tree is usually denoted by a blackish look on the leaves. This is caused by what is known as "sooty mould," which is a fungus growing on the sweet excretions of the scale and gives the tree a most objectionable appearance. The presence of ants may fre-

quently be noted; they feed on the honey dew and do no injury to the trees beyond spreading the infestation to the neighbouring ones. The soft scale—often called the soft brown scale—cannot be considered dangerous, but its control is difficult and also expensive. For this reason, the most effective measures should be taken to get rid of it. These are by the use of resin wash as a spray for young trees and fumigation for the older ones.

Australian Bug, often called " Dorthesia " at the Cape and Cottony Cushion Scale in America, is an unarmoured scale which may be found in many of our citrus orchards. The appearance of the insects when fully grown and resting finally secured to a twig or branch is distinct; the egg-sac, as large as a small pea, is white and beautifully fluted. Years ago at the Cape this insect caused widespread alarm and hundreds of trees were cut down so that it might have no means of sustenance and so die of starvation. Ordinary spraying and fumigation methods cannot be relied on to effect a clearance of this pest. Fortunately, we have a most valuable asset in the Vedalia, a little insect imported from Australia, and this wages constant war on the Australian Bug, with the result that the latter has lost its terrors for the orange growers. A supply of the Vedalia can be obtained from various sources and for these application should be made to the Chief Entomologist, Union Buildings, Pretoria.

Mealy Bug.—Orange mealy bug may be considered as one of the minor pests to which the grower is subjected. The name to a certain extent indicates the appearance of the insects, as they are covered with a white, powdery, mealy substance. A heavy infestation of mealy bug is unusual in well cultivated citrus orchards. There are members of the same family which infest the vine and also other fruit trees. Should it be necessary, spraying with resin wash is one of the most effective remedies. Biological control of this pest may also be anticipated in the near future.

White Wax Scale is found principally in the bush veld of the Transvaal, where it is indigenous on certain plants. It may be found on various kinds of trees, principally of the mimosa family. Occasionally it spreads thence to citrus orchards, but is rarely seen in sufficient numbers to cause alarm. The older specimens are quite liable to fall from the tree, and then owing to the weight of their waxy coverings they cannot return. In case of a heavy infestation, a thorough spraying with resin wash is usually effective.

Fruit Flies.—There are two or three kinds of these; the one most in evidence is of a pretty brown colour with yellow stripes across its back, and about the size of an ordinary house fly. It damages the fruit by laying its eggs just under the rind, a week or two before the softening stage of ripening is beginning in the case of deciduous

fruits and in the early stages of the yellowing of the orange. The eggs are inserted by means of the insect's ovipositor, an appendage with which it pierces through the skin of the fruit and through which the eggs are placed in position. Very soon they hatch out and little maggots appear and commence feeding; they have no legs, but manage to wriggle through the fruit in about three weeks, when they leave it for the purpose of pupating; this takes place in the soil, more flies emerge in a few weeks, and so it goes on.

Fruit flies cause much damage to many other fruits besides the orange, including the mango, guava, all kinds of stone fruits, loquats, persimmons, pome fruits and melons. The "Mally" fruit fly remedy is the best means of fighting this pest, which is one of the worst with which the South African grower has to contend. The remedy consists of sprinkling the trees by means of a hand syringe with a mixture of arsenate of lead, sugar and water as described under the heading of "Remedies." Some growers net the trees (in a small garden) with ordinary mosquito netting, which may save the fruit but does no harm to the flies. Flooding the orchard during the period when the insects are pupating is also successful in diminishing their numbers.

False Codling Moth.—This very much resembles the ordinary codling moth which is such a pest to the apple grower. It attacks most citrus fruits and a long list of others, including some stone fruits, guavas, pomegranates and also acorns. Its breeding places may be found amongst the many wild fruit trees which we have in the native Bush, in addition to cultivated orchards. The grub which injures the fruit has legs and is thus easily distinguishable from the larva of the Fruit Fly. Various spraying remedies have been tried against this pest, but nothing in the way of a specific remedy has been arrived at. The author has found that clean cultivation of the orchard, getting all implements as close to the tree as possible during cultivation operations, together with the gathering up and destruction of all fallen and infested fruit and the flooding of the land during the larval stage of the life of the insect, in combination, are, up to the present, the best methods of fighting the enemy. Holes may be dug in the orchard 4 feet deep into which all infested fruit may be thrown, covered up with soil and tramped down.

Fruit Moths.—There are a number of moths of different kinds and of large size which may occasionally do considerable damage to a fruit crop. They attack some citrus fruits, most stone fruits, and in addition apples and pears. These moths puncture the skin of the fruit with their probosces and gain their living by sucking out the juice from within. Decay sets in at each spot which has been punctured, and the general appearance of the damage done to the

fruit is very similar to that caused by fruit flies, excepting that there are no grubs to be found inside. These moths appear at intervals of a spasmodic nature; they may do much damage one year and not be seen again for a long period, possibly never.

The author first came in contact with them in 1906; in that year they were prevalent in the bush veld of the Transvaal, the breeding places of that particular type of moth were found to be in the wild castor oil bushes. Other kinds of moths have different ideas, and may frequent various kinds of bush trees. They are not often a pest on the high veld. Many attempts have been made to find a reliable remedy or preventative against them, but not to much purpose so far. Amongst others, the encouragement of bats, the use of lanterns suspended above water pans at night, the setting of a trap of dried grass under the trees into which the moths are supposed to retire at dawn and which are set fire to during the day. None of these methods can be designated as successful and the destruction of moths remains one of the problems which is still waiting for solution. Without doubt the freedom of the orchard site and surroundings from bush and long grass for some considerable distance is one of the wisest precautions which can be taken.

Thrips.—The presence of thrips has recently become noticeable in some of our citrus orchards. The thrip is a tiny dark brown or blackish insect which hops about when disturbed and congregates in the blossoms of the orange trees. It injures the young fruit in the very early stages of its growth.

It is found at work during and after the blossoming period and it is in the latter stages that it attacks the fruit and young leaves. The result in the former case is the formation of a scar, somewhat resembling that made by wind injury, which is frequently to be found round the stem of the fruit although it also may be seen in other parts. The leaves when attacked become deformed, elongated, twisted and have a leathery feeling. The fruit is not seriously injured by the insect, but its appearance is somewhat spoilt and as a consequence it is not worth so much on the market. Spraying with a nicotine spray before the buds open and after the petals have fallen or with a weak solution of capex at that period are the best and most effective remedies.

The Pests of the Apple, Pear and Quince

The worst pest which apple and pear growers have to fight is undoubtedly the codling moth with woolly aphis a good second.

Codling Moth.—The moth itself is a very pretty, small, brownish insect which is seldom seen by day. It lays its first batch of eggs when the apple trees are about shedding the petals from the blossoms and at that time the eggs are mostly laid in the calyx end of the

fruit; as the season advances fresh broods appear and the moth may lay eggs on any part of the fruit or on the leaves of the trees. As the eggs hatch, the resulting grubs eat their way into the apple and if left untreated an orchard may be rendered profitless by the ravages of this little pest. Treatment consists of poisoning the fruit by means of a weak arsenical spray, which is applied first at the time the blossoms fall and after that at intervals of some twenty-one days right through the season. The grubs in their early stages are destroyed when trying to eat their way into the fruit. Trapping the adult grubs as they crawl down the stem of the tree on their way to the ground to pupate is of great assistance in a campaign against codling moth. Bands made of sacking are placed round the trunks of the trees, and underneath these the grubs enter in order to find a comfortable home in which to undergo the change from grub to chrysalis. The bands should be attached to the stem of the tree by a single $1\frac{1}{2}$ inch 16 gauge nail placed in the centre of the bands, which should be examined monthly and all insects found therein destroyed, the bands being replaced and attached evenly and quickly by means of the nail. With proper care the loss of apples and pears from the work of the codling moth may be kept to under 5%.

Woolly Aphis.—The white woolly appearance of this insect is responsible for its name. It has been a pest of the apple for ages and infests both roots and branches of the trees and derives its sustenance by sucking the sap. It prefers to attack the tree in its most vulnerable part and is particularly busy on apple trees which have been injured in any way, such as by a bad hailstorm; it will always select a wounded spot in the bark, if there is one to be found, for its attentions.

It may be destroyed by spraying with some nicotine wash, and the use of this is always preferable to any of the prepared miscible oil washes. The insect infests the roots of the ordinary apple tree as well as the branches, so that eradication is difficult. Digging tobacco dust into the ground surrounding the trees has some effect on the insect in that stage. The use of root stocks which are "blight proof" is much resorted to, as by that means the insect is more easily combated. Biological control is also of very great assistance in dealing with this pest. A predatory enemy has been introduced during the last few years which has kept the aphis within very circumscribed bounds in those areas to which it has been sent, notably at Elgin in the Western Province of the Cape, and to the South of Johannesburg, where the acreage under apples is very large.

Pear Slug.—This is a small, slimy-looking slug, almost black in colour, which chiefly attacks pear trees; it is more in evidence in

the Western Province of the Cape than elsewhere in South Africa. It eats away the surface of the leaves and, unless attended to, will make the trees look unsightly besides damaging them by depriving them of their organs of respiration. It is easily got rid of by throwing fine sifted soil over the trees in as nearly the form of dust as possible. Spraying with arsenate of lead is an effectual remedy, but is not always resorted to as the dust treatment is so successful.

Red Spider is a tiny red animal almost invisible to the naked eye. It and other similar types are liable to injure the foliage of the apple and almond. Plums of the domestic type also suffer, and in a lesser degree the Japanese varieties. An effective treatment is spraying with capex (lime-sulphur) during winter and if renewed and serious attacks are experienced during the summer, dusting the trees with sulphur may be tried with every prospect of success, especially when the days are hot.

Scale Insects.—San José or Pernicious Scale, if left untreated, is a menace to most deciduous trees. With ordinary care it is easily got rid of. The lime-sulphur treatment during winter when the trees are bare of leaves is the best remedy.

Grey Scale is similar in appearance to the ordinary observer to the last-named but is less dangerous; it may be treated in the same way.

It is recommended that growers should submit specimens of any scale insects with which they are unacquainted and which they find on their trees to the nearest Government Entomologist.

Insects common to Stone Fruits not already mentioned

Fruit Beetles.—There are numerous kinds of beetles which attack fruit in the ripening stage and against which no satisfactory measures can be taken. Many of them, especially in the north and eastern parts of the Union are of large size and have black and yellow colours usually in the form of stripes. They can do lots of damage and so far the only remedy of any value has proved to be hand picking. This should be done early in the morning, and if the mornings are cold, the beetles may be shaken on to a sheet from the trees and afterwards destroyed. Hand pickers go round with paraffin tins with a little water in them on which paraffin has been poured in small quantities. Both methods are far from satisfactory and a specific remedy would be warmly welcomed. The picking of as much fruit as possible prior to the softening stages is wise, although the quality may suffer.

Leaf Beetles.—There are numerous types of these smaller beetles, which are to be found eating the tender foliage of fruit trees in the spring of the year. Spraying the leaves with arsenate of lead will poison them, but it is not too good for the young foliage. Picking

them off by hand in the early mornings is attended with good results and the frequent stirring of the soil at the foot of the trees is also desirable, as many of these little fellows retire below ground after feeding.

White Peach Scale is found principally on peach trees, though it infests some other fruits and also the indigenous syringa. This scale is only dangerous when neglected. It may be easily eradicated by the use of the lime-sulphur spray during July.

Peach Aphides.—There are two kinds of these which are specially injurious to the peach tree and in a lesser extent to the plum. They are either black or green in colour. Both are bad and the green aphis is worse than the black. They swarm in myriads over the young growths in the early spring, causing the leaves to curl up and die and interfering materially with the vitality of the trees and not infrequently killing them. Both types are present in force on the high veld of the Transvaal, where they constitute a serious menace to the culture of the peach tree in gardens. In orchard form, the pest is less frequent, doubtless because the soil is kept cleaner and more free from weeds and vegetables, in which some of the insects hibernate. Others may secrete themselves in cracks and crannies of the bark and again others (in this instance gravid females) retire into the soil round the collar of the trees to hibernate, coming up in the spring to renew their work of destruction.

Treatment, to be successful, *must* be absolutely thorough. During winter the ground round the tree trunks should be removed and the upper roots drenched with scalding water, which will destroy quite a number of the females. No hesitation is necessary, hot water does not harm the roots. Tobacco dust may be dug in also round the stem of the trees and a sharp look out must be kept in the very early spring and the trees thoroughly drenched with nicotine spray as soon as the first aphis is seen. Repeat the treatment before the trees bloom and again once or twice afterwards if necessary. Too much care cannot be taken to keep this pest well under control.

Grasshoppers occasionally inflict a good deal of damage on young orchard trees. Those of the citrus family are principally affected, but the taste of these insects is a catholic one, and no young fruit trees are immune.

As a rule, visitations are uncommon, but are more liable to take place when fresh plantings are made in new situations with large areas of uncleared veld and bush surrounding the orchard site. The damage is done by the insects eating the young leaves and tender shoots in the early stages of their growth and thus leaving the tree in a defoliated condition. Prevention may be partly secured by clearing off all veld grass and bush in the immediate neighbourhood of the orchard. Poisoned baits may be tried and

sometimes are a success. Turkeys and guinea fowls in the orchard are useful allies in fighting this pest.

Insect Enemies of the Fig—In addition to red scale which sometimes attacks the fig, *Greedy Scale* may also occasionally be found to infest this tree. Neither of these pervades the whole Union. Greedy scale is lightish brown in colour, round in shape, and is usually found on the young twigs. It can be satisfactorily dealt with by spraying during the winter.

Borers may infest either twigs or trunks of the fig tree, they are also found sometimes on other fruit trees, such as the apple and pear. In the fig the stem borer is particularly destructive in the Transvaal. The borer is the larva of a large black beetle which may be seen at work on the young growths of the fig in late November and December, denuding them of their smaller leaves. The borers penetrate the stems of the trees and the holes may easily be found by searching for them. A few drops of paraffin squirted into each will usually bring the grub out or a long thin wire may be inserted into the hole with the object of impaling its inmate. Protection of the lower parts of the trunk and ground in the immediate vicinity by means of fine-mesh wire mosquito netting has been tried, but is not entirely a success.

Twig Borers.—These are found on some fig trees; they bore into and destroy the young twigs. As they live in the wild fig trees so common in the Transvaal, it is wise to destroy all near at hand, as well as all the infected twigs.

CHAPTER XXXIII

COMMON DISEASES OF FRUIT TREES

Sooty Mould of the Orange.—This most unsightly fungus is found on citrus trees which are attacked by soft scale. It affects principally the sale of the fruit by giving it a blemished appearance. To some extent also it affects the health of the trees, as, when the leaves are covered with the mould, it is impossible that they can carry on their natural functions properly. Trees affected with this fungus should be treated in the early stages by spraying for the scale; when this has been cleared away the sooty mould will disappear also.

Splitting of Oranges.—This is more often than not the result of some irregularity in the water supply. After a period of dry weather and a possible shortage, heavy downpours may cause an abnormal flow of sap which the fruit is unable to assimilate. The result is that it cracks. With careful attention to the regulation of irrigation water, the tendency to split will be found to diminish considerably. Frosts are also responsible occasionally for the splitting of the orange; fortunately loss from this cause is not of frequent occurrence.

Sun-scald is more frequent on lemons than on any other member of the Citrus family. It is largely due to lack of pruning of the trees. Unlike the orange, the lemon should be pruned so as to afford a sufficient number of leaves to shade the fruit and so prevent sunburn. Long straggling branches should not be allowed.

Collar Rot.—This disease was far more prevalent in South Africa formerly than it is to-day; this is perhaps due to improved methods of irrigation and the use of more resistant stocks. It is called by a number of other names, such as "Root Rot," "Gummosis" and "Mal de Gomma." The disease is heralded as a rule by an abnormal crop of fruit and after that, unless search is made and the trouble discovered, it is extremely likely that the tree will die. Collar rot should be sought for near the ground just round the trunk of the tree. This gives the name to the disease. Gum may exude from the diseased places and the bark will be discoloured; possibly it may have burst and become loosened from the stem of the tree, showing the wood beneath; there is a distinct smell of a very unpleasant nature which accompanies the trouble. The rotten

bark may be found to exist on one or more roots and should be followed downwards until there is no more evidence of its presence. Surgical measures are then necessary. All the diseased bark must be removed by cutting round it at some little distance from the edge, so that all the infected part may be taken off; this needs a sharp knife. When every little piece of rotten material has been removed, the wound must be thoroughly painted over with either carbolineum or Bordeaux paste and the earth allowed to remain thrown up away from the trunk of the tree for some time or until it has healed over; this, in many cases will start to take place within a few weeks. Prevention of the disease is largely ensured by the use of the rough lemon as a stock on which to bud the orange. Seedling orange trees are far more susceptible than budded ones, being on orange roots. Common-sense methods of irrigation will also go a long way to assist matters and do away with trouble from collar rot.

Scaly Bark.—This is one of those diseases which must be dealt with promptly and decisively if it is to be controlled at all. Otherwise, its spread is certain and the result disastrous. It has been recently observed that a Government notice states that all trees suffering from this disease must be destroyed without compensation to the grower. It does not apparently attack the lemon, and the orange is the chief sufferer, although the grape-fruit is not immune. Dr. Doidge has divided the stages of the disease into three in number:—

1st Stage.—It appears on the trunk of trees over five years of age in the shape of hard scales or flakes of dried bark which may be up to 2 inches in diameter and $\frac{1}{16}$ to $\frac{1}{8}$ inch in thickness. Under these scales the bark is rough and of a lightish brown colour. When gum begins to exude from the affected spots it may be accepted that the disease is well established.

2nd Stage.—The disease develops until it may encircle the limb on which it is found. Fresh scaling of the bark on the advancing edge continues and exudation of gum takes place at times only and is not continuous.

3rd Stage.—The wood now is seriously affected, and there is a reddish discoloration under the affected parts which increases until a large part of the wood may be discoloured, decay sets in and the strips of bark begin to die. The tree shows a stunted appearance, twigs die back and new growths are small and without vigour. One or two limbs only may be affected or the whole tree may show serious effects.

Treatment.—If scaly bark has been detected on the trunk or limbs in the first stage, the affected bark and a circle of $\frac{1}{2}$ inch beyond it may be cut out entirely right through to the wood. After drying,

this may be painted with some disinfectant, and later should be protected with a coat of some wood-protecting substance. Disinfectants already mentioned may be used.

It may be said that scaly bark is capable of eradication *only* in the first stage; at a later date the necessary removal of bark would have to be on such a scale that the well-being of the tree would be so much impaired that its continued existence would be jeopardized. The question then arises as to whether it is wise to allow the tree to remain and bear what it would before its end, or to dig it out at once and plant another. This has now been answered by the Department as previously stated.

Ring Blotch.—This is a widely-spread trouble in South Africa. Little is known as to its cause and still less as to how to get rid of it. The author happened to be successful at the Warmbaths Experimental Station some years ago in disposing of it effectually by heavy cover crops of velvet beans annually for a couple of years. The appearance of the disease is evident from its name, blotches of a roundish shape appear on the leaves of the trees, they are yellowish in colour and may increase in size until three or more may run together; in severe cases the blotches may appear on the twigs also. The leaves are apt to die before their time and fall off, leaving the tree or a limb in a defoliated state. As stated, treatment and cause are both obscure and little information of real value is obtainable. If any doubt exists as to its presence, sample leaves should be sent to the Government Botanist, Pretoria.

Mottled Leaf.—This is a disease which may be described as "Anæmia of the orange tree." The word "chlorosis" is more generally in use. Chlorophyll, the colouring matter of the leaves, is improperly developed. They are yellow in colour, green not being in evidence, excepting in the veins of the leaves.

As a consequence, the nutrition of the tree is imperfect, twigs do not grow out strongly and healthily as they should, and as the trouble advances the limbs show signs of dying back and the whole tree may become unhealthy and gradually worthless.

No successful treatment has yet been discovered for this disease. The author, in consultation with Dr. Doidge, applied no fewer than nine different treatments to trees affected with mottled leaf as follows: 1. Unslaked lime. 2. Unslaked lime and copper sulphate. 3. Nitrate of soda. 4. Sulphate of ammonia. 5. Kraal manure. 6. Superphosphates. 7. Ground bone. 8. Iron sulphate. 9. Copper sulphate. No apparent result followed in any one case from the use of these. The lime dressings were heavy. Cover crops were also used, but no information of any value was secured from anything. Dr. Doidge states it to be an obscure disease, and that appears at the present time to be the exact state of the case.

It was noticed first in California and has caused investigators there no end of trouble, with no better results than have been arrived at in South Africa. Fortunately, it is a disease which is not widespread here at present, and it is to be hoped that such will continue to be the case.

Common Diseases of Deciduous Fruit Trees and Vines

Crown Gall.—This is mentioned first because it is one of the troubles which are more prominently before the fruit grower just now than any other. It is not confined to South Africa, but is known over a large portion of the fruit-growing world. It is particularly bad on peach roots; probably the pear comes next in susceptibility. The disease is proving a source of uneasiness generally to the fruit-growing public. As a rule, it is introduced into orchards and gardens by means of nursery stocks and when once developed it will, unless carefully watched, be the means of reducing crops and also the health and vitality of the trees. Left to itself, it may cause death sooner or later to the affected trees. On the other hand, there are instances, where the attack is not so severe, of trees continuing to put on a fair growth and yield moderate crops for many years.

Crown gall is unfortunately so common that it is not necessary to describe its appearance. Fraser, in "American Fruits," page 196, says:—

> "The evidence indicates that *where bacteria are present* the disease is a true plant cancer and can be transferred to low-temperature animals, such as fish, producing growths which are recognized as carcinoma or cancer. The bacteria causing this trouble will enter the plant through a wound. They may be carried by irrigation waters, they may be transferred by using scions or cuttings from diseased plants, by the pruning knife, or the grafting knife, or by insects. When they invade the cell they stimulate it into excessive activity resulting in the galls which are apparent. Galls are found on a large number of plants as the almond, apricot, cherry, clover, cotton, English walnut, grapes, peach, plum, prune, quince, tomato, turnip, etc."

There is no doubt but that the disease emanates from the nurseries in the first place and is, of course, distributed thence in the ordinary way of business. It is necessary, therefore, that the utmost care be displayed in the propagation of all fruit trees, the question of soil infection must be studied, the possibility of injurious bacteria borne in mind. It is almost certain that soil in which the disease has had a foothold will retain its ability to disseminate the

trouble. It is quite certain that seeds from an infected tree will reproduce infected stocks, so that the question of selection of trees from the nursery becomes one of the very greatest importance; scions from infected parent trees must never be used. The proposal to prevent the sale of nursery stock infected with this disease may have to be considered should any serious turn for the worse occur. Fraser (already quoted) says later:—

> "The whole problem is being reinvestigated and it is now recognized that the present system of inspection and destruction of trees is unwarranted."

It would, therefore, appear that in America at least as much interest is being taken in this gall disease as in South Africa. There are, of course, other galls and root rots, but they do not enter into consideration, being for the most part rarely found and innocuous. No real remedy has been discovered for crown gall, but the growth of the galls on the roots may be to a certain extent controlled by chiselling them off in the fall of the year, burning all the galls and sterilizing the tools used and painting the wounded surface over with carbolineum or Bordeaux paste. In some favourable cases, the disease has been stamped out by this method.

The exposing of the galls to the air and sunlight, when they are so situated that this is possible, has proved of the greatest benefit, and in some instances an entire cure has been reported. It is, of course, necessary to remove the soil from round the collar of the tree so that both sun and air have ready access to the infected parts.

Mildews.—These are common to the vine and certain types of apples; in the latter instance the varieties are pretty generally known which are subject to this trouble.

Coastal districts and others where misty conditions of the atmosphere prevail are most subject to attacks of mildew. The application of sulphur by means of dusting or a spray is the best remedy. The same may be said in the case of the vine. It is usual in all Cape vineyards to sulphur the vines twice or perhaps more frequently every season. The simplest way to do this is to take a square piece of canvas of suitable size, open it out flat and pour on the sulphur needed, then gather up the four corners and tie them up; the sulphur may then be readily shaken over the vines by hand. Dusting machines are to be had, also small bellows which are made for that particular purpose.

Curl Leaf.—This is a fungus disease to which the peach and nectarine are specially subject; it rarely attacks any other kind of tree. The leaves become curled up, the tissues swollen and thickened, often discoloured, and, if left untreated, will fall off, leaving the tree without a leaf. Treatment, however, of a preventive

nature invariably results favourably. A winter spraying of lime, salt and sulphur or Bordeaux mixture will render the trees immune to the attacks of this fungus for the following season. This should be an annual matter so as to render curl leaf impossible.

Shot-hole Fungus.—This is worst on the apricot, though it occurs also on the peach, cherry, almond and plum. Its appearance is as if the leaves had been subjected to a discharge of shot, the little holes looking more like that than anything else. Damage to the fruit is not serious. Often it is not considered worth the expense to spray the trees in order to get rid of it. When, however, this is done the Bordeaux mixture at 4 × 4 × 50 may be used.

It is quite safe to apply it when the trees are in full foliage. Peach blight or rust, which appears during the months of March and April, may also be treated with the same spray.

Walnut Blight.—This is a disease which, until recently, has been unknown in South Africa. It is recognized easily on sight by the look of the walnuts, and is, as a rule, only discovered when it has attacked them. Each nut has dark brown to black-looking blotches on the hull which penetrate through the skin to the nut, which is also blackened. The hulls are difficult to separate from the nuts, which are smaller than ordinary, sometimes deformed, and the contents are rendered bitter, shrunken and unfit to eat. As the disease progresses, as it will always do if treatment is not given, the nuts become quite black and worthless. No remedy has hitherto been found. The author had in California a long experience with it and found that the only thing which helped in any way was renewed applications of the Bordeaux mixture, and at the best this treatment was not too satisfactory. Fortunately, the trouble is not yet prevalent here, with one or two exceptions, and should be confined to its immediate areas.

Lichens on Fruit Trees.—An unsightly appearance is given to any fruit tree which may be suffering from the presence of either moss or lichens. Some damage is also done to the tree, as each has to draw its sustenance from it. They are, however, easily got rid of. When regular winter spraying is carried on as it should be in most old orchards, lichen is absent. When trees are neglected they may be cleaned quickly by spraying with a mixture of caustic soda and water at the rate of 1 lb. of soda to 10 gallons of water. Spray with care, as the mixture should be kept away from the eyes.

Sour Sap.—This trouble is principally confined to the apricot. One may sometimes see an apricot tree perfectly well and healthy at the beginning of the week and dead or dying at the end. Fortunately, this is of rare occurrence. Sour sap may cause one or more limbs to die whilst the remainder will be sound. It is, as a rule, caused by a surplus of water at the roots, though this is not

always the case. Treatment of one or two limbs may consist of cutting them out entirely. When the whole tree shows signs of going under, as it may, by drooping its leaves suddenly, it may be regarded as too late for treatment; but where it is clearly shown that water at the roots was the cause of the trouble, drainage may be resorted to in order to prevent further damage.

Bitter Pit is one of the troubles to which the apple is subject, not only in South Africa, but also in many other countries where apples are grown. The name " bitter pit " is given it on account of the fact that apples which suffer from it have a marked " pitted " appearance, due to a breaking down of the cells immediately beneath the skin where the pits appear. This causes it to fall in at those spots where the cells have given way. Certain varieties are more subject to this trouble than others, Cleopatra and Versfeld being about the worst sufferers.

The question arises as to what causes the breaking down of the cells; in other words, What causes the bitter pit? Many theories have been advanced in answer, but none of them, *per se*, is satisfactory. There is no doubt but that the disease is of a physiological nature; the fruit is affected, not by outside influences, but from the sap which it absorbs from its source in the tree itself. The tree, then, is responsible.

It is not possible for an apple tree to produce good sound fruit if it is standing in unsuitable surroundings; the tree cannot be in perfect condition. Without doubt, many apple trees in South Africa are not existing under ideal conditions, which should include:—

1. Suitable climate.
2. Fertile soil.
3. Adequate rainfall.
4. Perfect drainage.

When these conditions are absent the development of bitter pit is encouraged. In order to have a healthy tree which should bear sound fruit, it will be found that study of these requirements will be amply repaid. The author has seen an orchard of old apple trees in the Western Province (all Versfelds), which had been subject to severe attacks of the disease for years, bear a crop of fruit which was sold for £150 per acre without a single blemished specimen the first year after receiving a dressing of some 10 tons of stable manure per acre and a good irrigation. Previously the soil was lacking in fertility, and also water supply. Correction of existing defects in the above-named particulars is more likely to prevent bitter pit than anything else.

The trouble may appear when apples are kept in storage, and

this has been the cause of much loss in the past. Storage at a temperature of from 30 to 32° F. in a dry atmosphere is unfavourable to its development, while one of 34° F. allows the development to proceed (Fraser's "American Fruits"). It will be seen that preventive measures alone are advocated; when the trouble has once appeared in the fruit there is no remedy.

Water Core.—This is a peculiar condition of the fruit which may include the whole apple, but as a rule appears only in parts. On being cut open portions are seen to have a translucent, watery appearance as compared with the sound parts. Nothing may be seen on the outside of the fruit to indicate that water core is present. It occurs chiefly when a more than ordinary supply of water is afforded; heavy rains and a soil which is not too well drained go to assist the development of this trouble. It is not of frequent occurrence in South Africa, but is present under such conditions as have been described. Good cultivation, a moderate and uniform water supply without excess, combined with good drainage, will go far to prevent the appearance of water core.

Fusicaladium, known in Australia as Black Spot and in America as Apple Scab, is called in South Africa by its correct name, although somewhat abbreviated. It chiefly affects the pear in this country and is found in the Western Province of the Cape principally, where the bulk of our pear orchards are situated and where the climate is more favourable to the development of the trouble than in most other parts of the Union. The disease has a very serious effect on a pear crop and has been known to destroy almost completely what appeared to be a very promising setting of fruit.

In appearance it is a black scabby or scurfy spot which manifests itself on the fruit; it may be somewhat sunken, or, on the other hand, raised on the skin, it attacks the fruit at any time during its development and will attain such proportions as to render the crop valueless. Various remedies have been tried, ordinary Bordeaux mixture being generally in use now, but this is not entirely satisfactory. Spraying should be done while the blossom buds are still unopened and again after the fruit has become well set, with perhaps a third spraying if necessary. McEwan, in his "Fruit Growers' Handbook," tells what has been done in Australia, where the trouble is more frequently found on the apple than on the pear. Amongst other remedies tried there, those mentioned here have proved fairly successful. Bordeaux mixture at the rate of 6 lb. of copper sulphate to 4 lb. of lime with the addition of 3 lb. of salt, and Bordeaux mixture as above with the addition of 1 lb. of caustic soda; water in each case 50 gallons.

Animal and Bird Enemies of the Fruit Grower

The personal experiences of the author will, it is considered, embrace all or nearly all the ills which may be encountered in the setting out of a new orchard or in the maintenance of an older one, from the above-mentioned foes.

Pigs.—In the Western Province of the Cape, after planting some 14,000 deciduous fruit trees on one of the Rhodes fruit farms, the first untoward experience occurred in the shape of the continuous visits of a neighbour's pigs. These animals persisted in rubbing themselves against the newly-planted young trees, in some cases rooting them out and in others so damaging them that many had to be replanted. After remonstrances, which, originally most polite, eventually became, at a later date, somewhat crude, if not rude, and extremely persistent, and were entirely without avail, high-handed methods were adopted. A raid was made on the culprits with fatalities of such a nature that no further trouble was experienced from that quarter. In a new country where fences of sorts go to form the boundaries of most farms, it is difficult without taking some precautions to prevent depredations of this kind; and it becomes necessary for individuals to make sure that their stock is not a nuisance to neighbours.

Goats.—The next trouble came from a flock of goats which appeared to have a special weakness for the tender leaves of plum and pear trees. In this instance, the owner was ready and willing to do his utmost to keep his animals within bounds and also to pay for the damage done. The belief is widespread that the tooth of a goat is poisonous to any young growths and that after being nibbled by them trees will never thrive—in fact, sometimes die from the effects. The trees in question afforded no criterion, as they were all so badly injured that they had to be replaced by others.

Buck.—Small buck (Steenbuck) were the next to give trouble. These pretty little animals showed no preference for any particular kind of tree, but ate the young twigs of peaches, plums and pears indiscriminately. Occasionally one would get shot, but as they visited their feeding grounds when all good fruit growers should be in bed, this did not often happen. The most successful method of getting rid of them was by trapping.

Hares, Spring Hares and Rabbits.—In the Transvaal in 1906, after the young citrus trees were planted at the Warmbaths Experimental Orchard, they were attacked by hares. These came by night and in the early morning and gnawed the bark of the young trees, doing serious damage. Eventually they were circumvented by placing a piece of $1\frac{1}{4}$-inch mesh wire netting round each tree so that the animals could not get at them. Hares and buck appeared

equally fond of apple trees on the high veld at a later date, and as a preventative similar means were adopted and in addition newspapers were tied round the trunks of the trees, and, strange to say, proved effective.

Field Mice.—These little rodents proved very destructive on the high veld of the Transvaal in orchards which had not been properly cultivated and in which grass was to be found during winter round the trees. This proved a splendid cover for the mice and they nibbled round the bark of the trees with great enjoyment, in some cases completely girdling them. Many were thus destroyed and older ones with thicker bark also suffered damage. The mice were present in armies and for a long time all efforts to get rid of them were of no avail. At last a virus (Danysz) was found and administered with fatal effects, so that within a few weeks the last rodent had disappeared.

Destructive Birds.—There are a few birds which prove a nuisance to the fruit grower. The chief culprit is the Spreeuw, a species of starling. The Muisvogel is another little pest which is fond of most kinds of fruit. In addition, there are birds which attack the buds of fruit trees in the spring of the year; the latter as a rule are in some ways the friends of mankind, and it appears to the author that in all instances prevention is better than cure.

The wholesale slaughter of bird life is not pleasant to contemplate, so, as some means must be taken to preserve the fruit crop which may be of the utmost importance to the grower, the use of netting as protection to the trees and fruit in the garden is indicated. Cheap mosquito netting protects the fruit against fly pests as well as birds. Better still as a safeguard against the latter is a regular "bird netting" such as is common in England; it is made of twine and should be procurable locally.

For protection from the ravages of birds in the orchard, piccanin scarecrows with whips, an occasional shot or two, and, if the worst comes, poisoned wheat, placed out of the way of the fowls, may be resorted to.

CHAPTER XXXIV

VARIOUS SPRAYING COMPOUNDS, REMEDIES AND APPLIANCES

Arsenate of Lead.—This is the most generally used arsenical spray and preferable to arsenite of soda and Paris green. It is prepared either from the powder or paste. The former is now preferred, as pastes are liable to dry up in the receptacles in which they arrive if not used at once. Care must be taken to use only a reliable well-known brand of the poison. The formula is

Powder 1¼ lb. to 40 gallons of water
Paste 2½ ,, ,, 40 ,, ,, ,,

These quantities may be increased or reduced as necessary.

Arsenical baits.—

	Arsenite of soda (preferably 80%)	1 lb.
	Treacle (crude)	1 gallon
or	Cheapest sugar	8 lb.
	Water	8 gallons

Finely-cut barley (or other green stuff) about 3 muids.

or

	Paris green or Schiele's green	1 lb.
	Treacle (crude)	½ gallon
or	Cheapest sugar	4 lb.
	Water	1 gallon
	Bran	about 20 lb.

The first mixture is for bare ground or unimproved veld. Dissolve the arsenite and sweetening in the water and wet green stuff thoroughly with solution, then drain. Preferably use green stuff which particular pests fancy and always cut fine to diminish risk of poisoning stock. Bran may always be substituted for green stuff and in some cases horse-dung. Broadcast thinly about sundown. Against cutworms, treat land a few days before the crop shows.

The second mixture is for lawns and amidst cultivated plants. Dissolve sweetening in the water and use to poison bran. Work in poison. White arsenic or arsenate of lead powder may replace the Paris green, but the latter colour is advantageous. Have mixture

damp but not dripping. Broadcast about sundown 50 to 100 lb. per acre, or strew between the rows. Keep fowls away. Even at quarter strength and very thinly spread, this bait is sometimes surprisingly effective.

Mally's Fruit Fly Remedy.

	Arsenate of lead	1 lb.
	Treacle (crude)	3 gallons
or	Cheap sugar	25 lb.
	Water	40 gallons

Mix the arsenate with a little water. Dissolve sugar or treacle in remainder of water and thoroughly stir in the arsenic. Sprinkle over foliage in as nearly the form of rain as possible. This is best done with a garden syringe fitted with a fine rose. The mixture should be squirted up into the air so as to fall gently on the foliage. One syringeful should be enough for a ten-year-old tree. Spray every tree and all in the orchard liable to the fly. The remedy should be made fresh, as wanted. Spray trees just before fruit begins to soften and repeat at intervals of 10 days until fruit is off. Citrus fruits should be sprayed just as they begin to turn colour and two or three times afterwards during the season; those which hang late must get an extra spraying, the object being to kill the mother flies.

Bordeaux Mixture.

Copper sulphate	6 lb.
Unslaked lime	6 lb.
Water	50 gallons

or in some instances smaller quantities of copper sulphate and lime are sufficient, amounts of 5 lb. or even 4 lb. of each being enough to produce a mixture of ample strength. The mixture is usually alluded to as either 4/4/50, 5/5/50 or 6/6/50, according to strength. Suspend the copper sulphate in a sack, in a barrel containing 25 gallons of water. Hang it on a stick placed across the top of the barrel so that the material is under water. Slake the lime in a wooden vessel, adding a little water at a time until you have a thin paste, then place it in another barrel with 25 gallons of water. When cool, mix thoroughly. When putting the mixture in the spray tank or barrel take a bucketful of each—lime and sulphate—and pour them in together, thoroughly agitating the mixture in the barrel. This is a very thorough way of mixing and the result is always satisfactory.

Foliage may be injured if sufficient lime is not used. In order to

avoid this it is well to test the mixture before using, and then, if necessary, more lime may be added. The common test is to dip the blade of a clean knife into the mixture, keeping it there for a minute or so. If a thin film of copper be found to form on the blade, more lime must be added. All sprays containing lime should be strained into the pump barrel. Wooden vessels only must be used in preparing the mixture.

Lime Sulphur Solution.

Unslaked lime	10 lb.
Sulphur	20 lb.
Water	50 gallons

Warm about one-tenth of the water and add lime slowly. Mix the sulphur to a thin paste and stir into the lime when it is slaking. When this is over and all the sulphur added, keep water up to above one-fifth full quantity, stir frequently and boil until all the sulphur is dissolved. Cook for two hours. There should be no sulphur or lime left except in solution. Strain and dilute as required, keeping in a covered vessel. Use an iron pot for cooking. A few pounds of coarse salt are sometimes added, the idea being that the spray " sticks " better.

Resin Wash.—This is one of the oldest and perhaps the most reliable wash for armoured scale insects. It may be used with safety at any time. The only objectionable feature is, that if it is to be made properly it takes a good deal of supervision. It is no use to leave the preparing of this wash to an ordinary native.

Resin	24 lb.
Caustic soda—98%	5 lb.
Fish oil	2½ pints
Water to make	100 gallons

The resin should be crushed by pounding in a sack. Put 15 gallons of water in the cooking pot, stir in the caustic soda and oil and bring to a boil. Then very gradually add the resin, keep stirring all the time and keep on the boil until all the ingredients are dissolved and well mixed. Then boil for an extra ten minutes. During the cooking, add water slowly and see the boiling is not stopped, or the resin may settle. Add water to make 25 gallons. Cooking should be completed in two hours. Dilute to extent required. The mixture should be kept in a closed vessel.

Paraffin Emulsion.—This is a good spray to use for scale insects and aphides when resin wash is unobtainable. It is easy to make, and, though not as effective as resin wash for red scale, it may be

used as a remedy for that pest as well as for many other kinds of scale.

Soap (common yellow) . . .	1 lb.
Paraffin	4 gallons
Water	2 gallons

Cut soap into thin slices, put it in the water and boil until dissolved. Remove from the fire and at once add the paraffin and stir thoroughly, or the mixture may be churned up by placing the nozzle of a spray pump in it and pumping. Use one part to nine parts of water, preferably soft.

Miscible Oils.—There are many of these on the market in South Africa. Some of the best are made locally and there is little need to go outside our own proprietary remedies in this direction. They mix readily with water and are in request perhaps because they are so easily prepared. Harbas is amongst the best. Oils of this class are largely used on citrus trees for many kinds of scale insects. Also for aphides, etc., on deciduous trees. Spraying with any of the miscible oil washes on citrus trees should be done for preference on cool days, or in the evenings, on deciduous trees during the period when they are dormant. Care must be taken when mixing these oil washes that they are properly mixed and kept well stirred in the spray tank or barrel during use. The proportions in which they may be used are always mentioned on the outside of the receptacles in which the oil is contained, but it is well to do a little experimental work before starting out to spray the whole orchard.

Nicotine Sprays.—These are largely used as remedies against all kinds of aphis and they are hard to beat for that purpose. The insects are always found attacking the young and delicate shoots which are uninjured by nicotine sprays when made in accordance with instructions. It is always best to purchase some reliable well-known brand as these are manufactured under strict supervision and contain a percentage of nicotine which never varies. The best nicotine spraying materials are put up in South Africa, amongst them the "Lion" brand is perhaps the favourite. If tobacco is used, as may sometimes be the case where tobacco leaves or dust is plentiful, there can be *no* guarantee as to the actual nicotine contents of a spray so made. Experimental work is therefore necessary to find out the right strength at which it should be used. Most nicotine manufactured washes may be safely applied when diluted with 80 parts of water to one part of the mixture.

Powder for White Ant Pumps.

White arsenic (finely-powdered) . .	3 parts by weight
Sulphur	1 part ,, ,,

Mix thoroughly and pump into workings by means of the Universal Ant Exterminator or similar pump. Directions for use are sent with most of these pumps. A fire is lighted in the lower compartment, the powder placed in it and the fumes are pumped into the runs by means of a connecting tube. One of the best remedies against white ants.

Fumigation by means of hydrocyanic acid gas is by far the most efficient and in the end economical means of controlling all kinds of armoured scale insects on citrus trees.

Formerly work of this nature was carried out entirely by means of what is called "The Pot Method," which is described very completely and thoroughly in a pamphlet by Mr. C. P. Lounsbury, late Chief of the Entomological Division of the Agricultural Department, which is supplied free on application to that Department.

More recently, fumigation by means of liquid hydrocyanic acid gas has been introduced and is becoming somewhat popular. The liquid is put up in sealed glass ampoules or tubes in varying quantities for use on different-sized trees, they may contain from 6 to 60 c.c., and their use is very simple, it does away with the many pots and pans which were necessary when the "pot" method was the one in general use. Tents are needed just as previously, the gas is set free by the breaking of the ampoule under the tent; this may be done by a variety of means which are left to the user. It is claimed that this gas is absolutely pure and volatile and leaves no poisonous residue as is the case with the old method. The ampoules are made locally and there are professional fumigators who use only this means of fumigation.

Another means of fumigation has been brought before fruit growers recently, and that is by means of "cyanogas" produced from "cyanodust." The actual fatal effects are brought about by the same means as in the two previously mentioned methods. It is claimed by the introducers of this dust method of producing the gas that a "kill" of 100% is secured when used against red scale. If this statement is correct, then a decided step forward has been made in reducing the troubles of the fruit-grower. The dust was introduced from America, but is now being made in South Africa, and a supply is available from Messrs. Kynoch and McDougall, of Durban. The method of application is just as simple as that of the liquid gas, the dust is pumped into the tent where it at once volatilises and becomes gaseous; it has the advantage of not injuring the tents in the slightest degree. White ants and rodents of many kinds are being destroyed by means of this "dust" method.

Recently, the African Explosives and Industries, Ltd., have placed on the market a new fumigant known as "Zyklon." For some considerable time the new material has been the subject of

investigation at their Umbogintwini factory in Natal, where the question of its manufacture in this country has been studied. This new fumigant is no more costly than other hydrocyanic acid preparations, and as conclusive experiments on a large scale in well-known citrus groves in South Africa have clearly demonstrated both its efficiency and simplicity of application, it appears likely that it will supersede all other existing methods of fumigation.

Readers are referred to the many professional fumigators for all particulars in connection with these, the latest methods in fumigation; there are quite a number now engaged solely in work of this nature.

Disinfectants are needed for use in cases of collar rot in citrus trees, and in any instances where injury to the bark of any kind of fruit tree has occured, whether above or below ground. A very useful one is

Bordeaux Paste.—This is made by dissolving 1 lb. of bluestone (copper sulphate) in 3 quarts of water. The bluestone is best dissolved by suspending it in a sack in the water overnight. If it is pulverised, and suspended in warm water, it dissolves more readily. Lime which has been air slaked should not be used, quicklime is needed. If covered to prevent evaporation, each ingredient will keep indefinitely. For larger quantities use 12 lb. bluestone dissolved in 9 gallons of water, 24 lb. of quicklime slaked in 9 gallons of water. When the lime is used stir together equal parts by volume of each, making enough of the mixture to last several days, leaving the remainder unmixed in separate vessels. Bordeaux paste may be applied with large brushes, like whitewash.

Carbolineum is also used as a disinfectant at the rate of one part Carbolineum to an equal quantity of water.

Spray Pumps and Spraying.—The successful use of any of the various sprays or washes advocated for combating the attacks of insect pests and plant diseases depends primarily on the individual whose object it is to rid an orchard of its pests, and, secondly, on the machine which he employs to distribute his spraying material.

The purchasing of the ingredients should be done with the idea of procuring the best possible in each case and rejecting a second-rate article, even though it may cost less money, because goods which are low priced are very often not at all cheap.

The mixing of the different ingredients will require to be done carefully and not left to uneducated labour, unless, as may possibly occasionally happen, it becomes compulsory; then the use of some kind of measure instead of the scales tends to diminish the possibility of error. A native may sometimes be trusted to put in so many tins of an ingredient when he could perhaps not understand exactly how to weigh it.

The cooking of such washes as lime-sulphur, or the resin wash should be closely supervised and every possible care taken to follow out instructions. The mixing of the quantities prescribed must be watched and when every precaution is taken there is a good prospect of successful results.

The fact that the spraying materials must come into actual contact with the disease or insect against which they are used makes the operation of spraying one which also requires special care. No matter how perfect the machine may be, it must be used with intelligence and thoroughness; in fact, the latter should be the watchword of all spraying work. Both sides of every leaf, above and below, must be wetted by the material, every twig and branch also, and if the soil is removed from round the trunks of the trees to a depth of 6 inches and the exposed surface sprayed so much the better.

In addition to the necessity for treating trees in this manner against attacks of an ordinary nature to which they may be subjected in the way of diseases and pests, it is considered a sound policy to undertake an annual spraying as a safeguard or preventative against certain pests and also for the purpose of acting as a tonic for the general health of the trees. Not all the different washes are to be considered useful for his purpose, such, for instance, as the miscible oil washes; these should only be used for some definite specified case, on the other hand, a spraying with lime–sulphur undertaken at the close of the pruning season for deciduous trees may be regarded as money well spent; it is, in fact, an insurance policy against sickness.

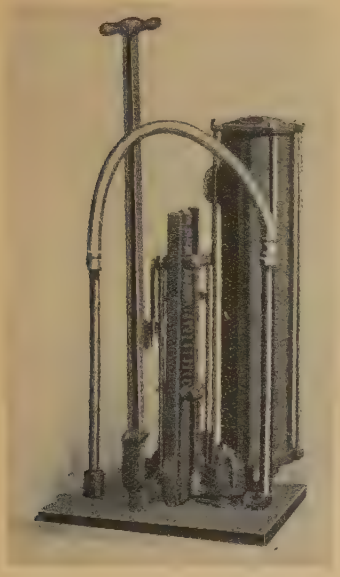
The choice of a pump for spraying purposes will depend on the class of work to be done and its extent.

For nursery purposes, the knapsack pump is very suitable, it can be carried on the back of the workman, who is able to pass up and down the rows of the trees readily, spraying each row in turn. The only possible objection to the use of this machine is that the receptacle holds but a comparatively small quantity of spraying material. A larger capacity is to be found in the cab or barrow sprayer, which is sufficiently small to be wheeled between the nursery rows. Its tank will hold about three times as much spraying mixture as the knapsack. The ordinary machine of this type has a capacity for about 15 gallons. Either of these pumps may be used and might prove equal to the requirements of a small garden. They may also be used for whitewashing anything which requires it, such as walls, fowl-houses, etc. Care should be taken to strain the wash and to use a special nozzle for the purpose.

Small garden syringes are also in demand and are particularly useful for distributing " The Mally Fruit Fly Remedy " in orchards as well as for general purposes in the garden.

An orchard of 10 acres or more may be dealt with by the use of an ordinary spray pump, capable of maintaining an air pressure of 100 lb. The spray receptacles of these are first charged with air, which, under compression, maintains a steady flow of spray material through the attached hose-pipes.

There are many different makes of these pumps on the market, mostly of American manufacture; the prices are usually high, and it is fully time that such an article was produced locally. Not perhaps that orchardists would pay less for them, but the money



SUITABLE PUMP FOR TWENTY-ACRE ORCHARD.

BARREL PUMP FOR SMALL ORCHARDS.

would remain in the country; it is quite a simple thing to make a really good spray pump, and the author has seen a reliable article turned out by a farmer for use on his orchard. These ordinary pumps are hard to beat; they do very good work at a low cost, and it is an open question whether the more expensive power outfits should be purchased or this class of pump used in duplicate and triplicate form, as needed.

Power pumps are without doubt the last word in orchard accessories, and when very large numbers of trees have to be sprayed their use is justified, principally on account of the rapidity with which the work may be done. It is possible to maintain very high pressure with these machines which are capable of distributing

from 20 to 40 gallons of spray material per minute through a double line of hose pipes. The application of sprays should always be made under a high pressure.

In all circumstances it is wise to purchase the very best of these obtainable; there are certain recognised makes specially prepared for the purpose, and these should be secured even if they cost double the price of an ordinary one.

Extensions in the shape of two 8 to 10 feet rods with nozzle attachments are needed for all these pumps, and hose pipes used should not be less than 40 feet in length; this enables the sprayer to get completely round each tree. Instead of these extension rods,

SPRAYER SUITABLE FOR 100-ACRE ORCHARD.

a spray gun has recently been introduced, and this may take the place of the rods last mentioned, if preferred. It is claimed that one man can, with a gun, do as much work as two men with rods; they are easy to handle and a turn will alter the spray produced from a thick mist to a heavy wetting spray.

The necessity has arisen lately of using all arsenical sprays with the closest reference to the quantity of residue left on the fruit after spraying. From this viewpoint and for this purpose, the "gun" is specially well suited and with disc or Bordeaux nozzles an extremely fine mist can be produced which will leave a minimum of arsenical residue on the fruit.

It is well to keep a supply of clamps, hose-menders and a few of the different spare parts likely to be needed in hand; this precaution may be the means of saving many hours of delay.

CHAPTER XXXV

ODDS AND ENDS

The Origin of the Maltese Blood Orange

Pharmacists are often (especially if they are known to take an interest in plants) asked questions which are very difficult to reply to satisfactorily, but which it is sometimes wise to answer if it is desirable to maintain their reputation for being scientific men. A question of this kind put to Mr. Hirst, of Scarborough, England, as to the origin of the blood orange was answered correctly by him, but was contradicted by the editor of a floral magazine, who ought to have known better than to quote the antiquated idea of that fruit being the product of a bud of the common orange grafted on a pomegranate, an idea which was exploded as long ago as 1818 in Risso and Poiteau's "Histoire Nat. des Oranges." Mr. Hirst asked the editor of the *Pharmaceutical Journal* for an authoritative opinion on the subject, who referred the question to me and asked me to ascertain and report whether the actual origin of the fruit was known. I therefore attempted to solve the riddle, but found on application to various botanical and horticultural centres in this country that practically nothing was known of its origin. It was a point of interest, therefore, to obtain an opinion from English botanists who have lived in the East to find out if the blood orange originated in Malta or had been imported from an Eastern country, since oranges were first brought from the East. According to Professor Targioni, the fruit of *Citrus aurantium* was first brought into Arabia from India in the ninth century A.D., it was unknown in Italy in the eleventh, but was shortly afterwards carried there, as it is said that St. Dominic planted an orange for the convent of St. Sabina, in Rome, in the year 1200, and in the fourteenth century both oranges and lemons became common in several parts of Italy.

Inquiries made of botanists who have resided in the East during the last half-century show that the Maltese blood orange did not come from India or Malaya.

Sir George Watt, C.I.E., in the "Commercial Products of India," writes of the Malta or Portuguese blood orange as introduced from Malta into India as late as 1852, although there existed more than one red orange in that country, *e.g.*, one known as

" Lallada " or the red Mandarin orange, and another known as the " Santara," a name generally accepted as an Indian corruption of Cintra, which would indicate that it was probably introduced by the Portuguese. The fact that the blood orange is not found on the eastern side of India might justify the assumption that it did not come from China, although the best oranges in India which are found on the Khasya Hills are universally regarded as of Chinese origin. In his opinion the only citrus which can be accepted as indigenous would be *C. medica* and not *C. aurantium*.

Mr. H. N. Ridley, C.M.G., who was for some years Director of the Botanical Garden at Singapore, of whom I also inquired if he knew anything of the origin of the Maltese blood orange, told me that it did not occur in the Malay Peninsula, and that it did not appear to be of Chinese origin. If it had been he would doubtless have heard of it from some of the numerous Chinese horticulturists in that country. But the blood oranges sold at Singapore were said to come from Malta. It is clear, therefore, that the Malta blood orange did not originate in China or India.

I also wrote to the Superintendent of the celebrated Hanbury Gardens at La Mortola, near Ventimiglia, where at least fifty-four varieties of citrus are cultivated, but he referred me to the Director of the Argotti Botanic Garden at La Valetta, Malta, for local information, and to Messrs. Rivers, fruit growers, of Sawbridgeworth, England, who cultivate many species. The latter wrote me a very interesting letter, pointing out in reply to my inquiries that the petiole of the leaf of the Malta blood orange is narrow and that the petals are white and similar to those of *C. aurantium* and the stamens are twenty in number, and that the stems are spineless both in young and old plants, but the leaves are somewhat rugose and curved from petiole to tip, and that the Maltese (egg) blood orange, the Maltese oval orange, and the Jaffa orange seem closely akin, resembling each other in habit, leaves, and pale buff-coloured pollen, the pollen being golden in most forms of *C. aurantium*, but white in the navel oranges. The blood colour, they state, is not constant, for of three oranges in a bunch two may have it and one not. Other blood oranges than the Maltese are grown in America, viz. Ruby, Sanford Blood, Saul Blood and St. Michael Blood.

But it was from Dr. J. Borg, M.A., the Superintendent of Agriculture in Malta, that I obtained the fullest and most authentic information. He kindly forwarded to me his work on " The Cultivation and Diseases of Fruit Trees in the Maltese Islands," published as late as 1922. This he accompanied with a most informative and authoritative letter, in which he pointed out the following statement on page 45 in his work :—

"The Malta blood orange is in all probability a local seedling sport of the ordinary orange, but its origin is wrapped up in mystery. As it was described and figured in Risso's natural history of the orange tribe, it was therefore well known and widely cultivated before his time (1818). The opinion so often expressed by popular writers that it is due to a cross with the pomegranate is, of course, altogether untenable."

Dr. Borg adds:—

"We know for certain that the blood orange now extensively cultivated in Sicily, Tripoli, etc., had been originally imported from Malta not more than sixty years ago. It has found its way to India, South Africa, Australia, America, etc. There is, however, no record in Malta concerning its origin, and I am very much inclined to believe that it is a local seedling sport, the blood being due to our red soil rich in iron. It is now, however, a very stable variety, and even if cultivated in soil comparatively poor in iron oxides, the red streaks or flush of blood in the pulp and in the rind are permanent, and are sure to make their appearance at complete maturity. My belief that it is a natural seedling sport due to our soil is substantiated by the fact that even the Bahia or seedless orange is 'bloodless' when over ripe, but in our gardens sometimes shows streaks of 'blood.'

"The tree of the Malta blood orange differs from that of the ordinary orange by its darker green foliage, and is often spiny, the last character being, as it were, a certificate that it originated from seed."

It is probably not generally recognised that there are two well-known forms of blood orange cultivated in Malta and occurring in commerce.

The Malta Blood Orange

1. This is the ordinary round or slightly flattened orange with a deep orange peel, which in December begins to take on the characteristic blood colouring, at the same time the pulp becoming heavily streaked blood-red, and later the colouring pervades the whole pulp, particularly its lower half. The fruit keeps well for a long time and travels well. This is the original Maltese blood orange. The Maltese name is Laring Taddemm.

2. The Malta egg-blood orange, which is distinguished in Malta as Laring tuil taddemm, tauuali or fin taddem. This is considered a very superior fruit and its origin is well known.

"It originated as a sport in a small orange grove at Casal Balzan

(Malta) on a tree of the Malta egg-orange towards 1850, and the sport was fixed and perpetuated by budding."

Dr. Borg knows the small garden where the original tree existed, of which one big branch has sported in this way. The leaves are usually curled and wavy, as in the egg oranges generally, but usually somewhat smaller. The fruit is generally oval or elliptical, or rarely roundish, the pulp and rind less heavily streaked and flushed red than in the Malta blood orange, and the blood makes its appearance in January, a month after its first appearance in the Malta blood orange. This variety has also been repeatedly exported, and is now grown in most countries where the orange is cultivated. The fruit is middling to large, oval or elliptical, rarely roundish, the peel is usually thin and smooth, but may be rather thick on trees situated in the shade. The pulp has few seeds, occasionally only one, a delicately sweet and acidulous flavour, and a distinct aroma. It is at its best in February and March, but is then too ripe to travel well. The egg blood orange is generally considered the best of the Maltese oranges, and is now largely planted in preference to the other varieties. Until a few years ago thousands of young trees were annually exported to other countries bordering the Mediterranean, as well as to America, India, Australia, South Africa, etc. Both these varieties of the Maltese blood oranges occur in British commerce. The original Malta egg orange, from which the egg-blood is a sport, is sometimes called the Portugal orange, and was introduced into Malta during the rule of the Order of St. John towards the close of the sixteenth century, and in all likelihood from Portugal by Portuguese knights.

The ordinary round orange of which Dr. Borg considers the Malta blood orange to be a seedling is known to have been cultivated in Malta for centuries before the advent of the Knights of St. John. In fact, there were ancient groves of this orange as far back as the fourteenth century, and in all probability it was introduced into Malta from Spain.

"The Seville or bitter orange is of greater antiquity, and was probably introduced into Spain by the Arabs in the ninth century. There are, of course, other blood-flushed or blood-streaked oranges such as the *Citrus hierocanthicum*, etc., but none of them was ever cultivated in Malta, so that the blood Maltese orange cannot be due to hybridisation. The Shaddock, *C. decumana*, which has a heavily streaked red variety, was only introduced into Malta in 1890."

The occurrence of a red flush in other fruits is well known, such as in the Wine sap apple, the pear *Pyrus sanguinale*, the blood peach, and the Waterloo strawberry, etc., but the colour of these does not appear to be affected by the soil.

The foregoing is from the *Pharmaceutical Journal and Pharmacist* of June 7th, 1924. It was sent to the author by Mr. Exell, of Sheffield, England.

Seville Oranges

The late Edmund Edmeades, of Oudtshoorn, when touring in Spain some years ago, secured seeds from an old and decrepit tree growing in the gardens of the Alcazar Palace in Seville. This tree is stated to have been planted by "Pedro the Cruel" in 1355. Edward, the Black Prince, son of King Edward the Third of England, was a friend of the said Pedro. Mr. Edmeades had a Bitter Seville orange tree in his garden which he had raised from the seed of this particular tree.

Orange Trees in Sardinia

Near Miles in this island of the Mediterranean are trees still standing and bearing fruit which are stated to be seven hundred years old.

Orange Trees in Paris

In 1886 there were 150 orange trees in the gardens of the Tuilieries, Paris. Of these some 43 dated from the reign of Francis, 1515–47, *i.e.*, some 339 to 371 years old.

Sweet Lemons

The sweet rough lemon makes a far better stock for the naartje than does the common rough lemon. Both are equally hardy, but also undesirable, apart from their value as stocks for other citrus varieties.

Grape fruit, *pomelo*, *pompelmous*, *shaddock*, *pummelo*, *pampelmoes*, *forbidden fruit*, *pompoleon* are all names applied to fruits of the same or closely allied families.

Grape Fruit

To enjoy this fruit thoroughly, it should be nicely prepared. There is a proper grape-fruit corer which removes all the seeds, leaving a cup-shaped depression ready to receive the sugar or anything else which may be fancied. Grape fruit with seeds in plenty are supposed to have a flavour superior to seedless varieties.

Varieties of Figs

Pliny, naturalist, who lived in the early days of the Christian era, knew and enumerated no fewer than 27 different kinds of figs.

Cocoa Nuts

Cocoa nuts are produced in larger numbers than any other kind of nut. Many thousands of millions are used annually in the

production of copra, oil cake, and coco-nut oil. Nearly two-thirds of the total supply comes from within the British Empire.

Apricot Trees

Some of the largest Apricot trees in the world are to be found in the Graaf Reinet district of the Cape Province. The illustration shows on the farm Mooiplaats, now the property of The African Irrigated Land Co., the growth made by the apricot in that area. Note the figure of the man beside it; he is 6 feet tall and of portly mien. This is not the only tree of its size. A number of others are to be found there. It is well over seventy years of age and bears heavy crops annually.

Cherry Trees in the Transvaal

At Florida, just outside Johannesburg, there is a cherry tree from which its owner took the sum of £27 in cash for the crop in 1927.

Brazil Nuts

The record crop of Brazil nuts was gathered in 1922 and amounted to 34,000 tons. Of these, England took 15,000 and America (United States) 18,000 tons. These nuts are not to be found in South Africa.

Monuments to Fruit Trees

Americans have at different times erected monuments to different varieties of apples—the McIntosh, Baldwin and Northern Spy have each one to their memory, as also has the Wealthy. The originators or propagators are usually mentioned on these tablets. Similar tribute has been paid to the Concord grape and its author, in the form in which it was finally introduced to the world. In this instance the monument was erected by the town of Concord, U.S.A.

Land and Water

An acre of land contains 43,560 square feet or 4840 square yards Each side of an acre measures 69·5 (approximately) yards. A square mile contains four square sections, each of 160 acres, making 640 acres in all.

A gallon of water weighs 10 lb.

2000 lb. of water equal 1 fluid ton.

An inch of rainfall means over 100 tons of water per acre.

70,000 gallons of water gives two 3-inch irrigations for an acre of land.

OLD SEEDLING APRICOT TREE AT MOOIFONTEIN, GRAAF REINET DISTRICT, CAPE PROVINCE.

PLANTING DISTANCES.

Vines planted square.

3 × 3 feet	per acre	4840	
4 × 4 ,,	,,	2722	
5 × 5 ,,	,,	1742	
5 × 6 ,,	,,	1452	
6 × 6 feet	per acre	1210	
6 × 8 ,,	,,	917	
8 × 8 ,,	,,	680	

Number of fruit trees per acre planted in squares.

10 × 10 feet	per acre	435	
12 × 12 ,,	,,	302	
14 × 14 ,,	,,	222	
16 × 16 ,,	,,	170	
18 × 18 ,,	,,	134	
20 × 20 feet	per acre	108	
22 × 22 ,,	,,	94	
24 × 24 ,,	,,	75	
30 × 30 ,,	,,	48	

Number of fruit trees per acre planted in equilateral triangles or septuple.

10 × 10 feet	per acre	500	
12 × 12 ,,	,,	347	
14 × 14 ,,	,,	255	
16 × 16 ,,	,,	195	
18 × 18 ,,	,,	154	
20 × 20 feet	per acre	126	
22 × 22 ,,	,,	103	
24 × 24 ,,	,,	86	
30 × 30 ,,	,,	56	

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Braine, C. D. H.	Johannesburg	Irrigation.
Brook, A. T.	Pretoria	The " Brook " Peach.
Buller, A. C.	Stellenbosch	The " Beauty " Plum.
Carter & Co.	Maritzburg	The Chestnut.
Costa, Mr.	Newlands	The Persimmon.
Dix, Mr.	Natal	Apple Varieties.
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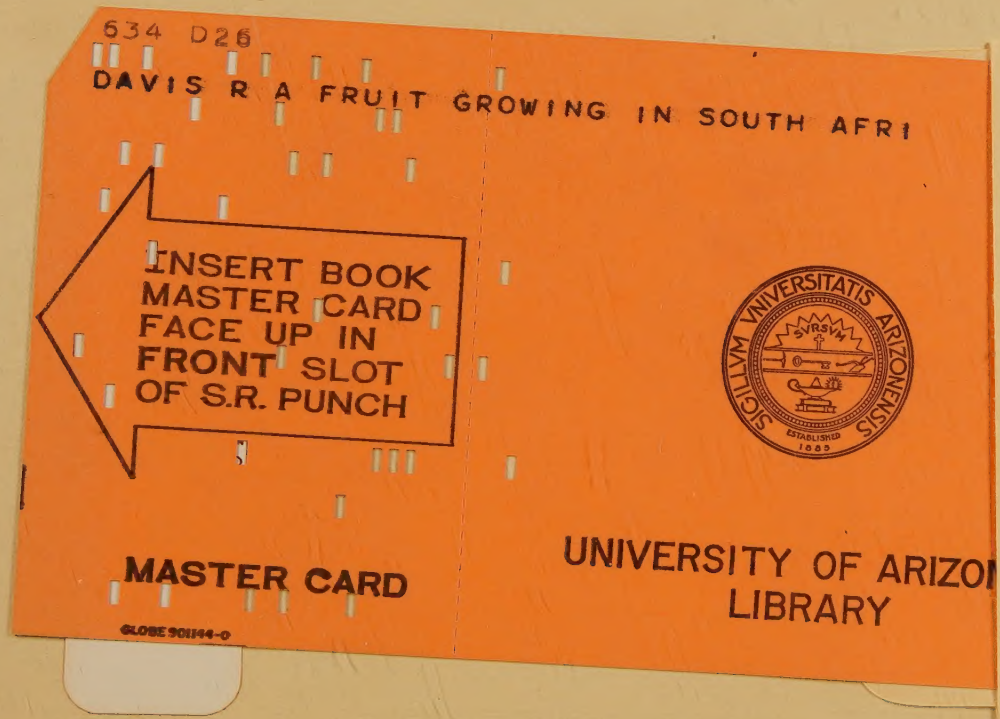

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